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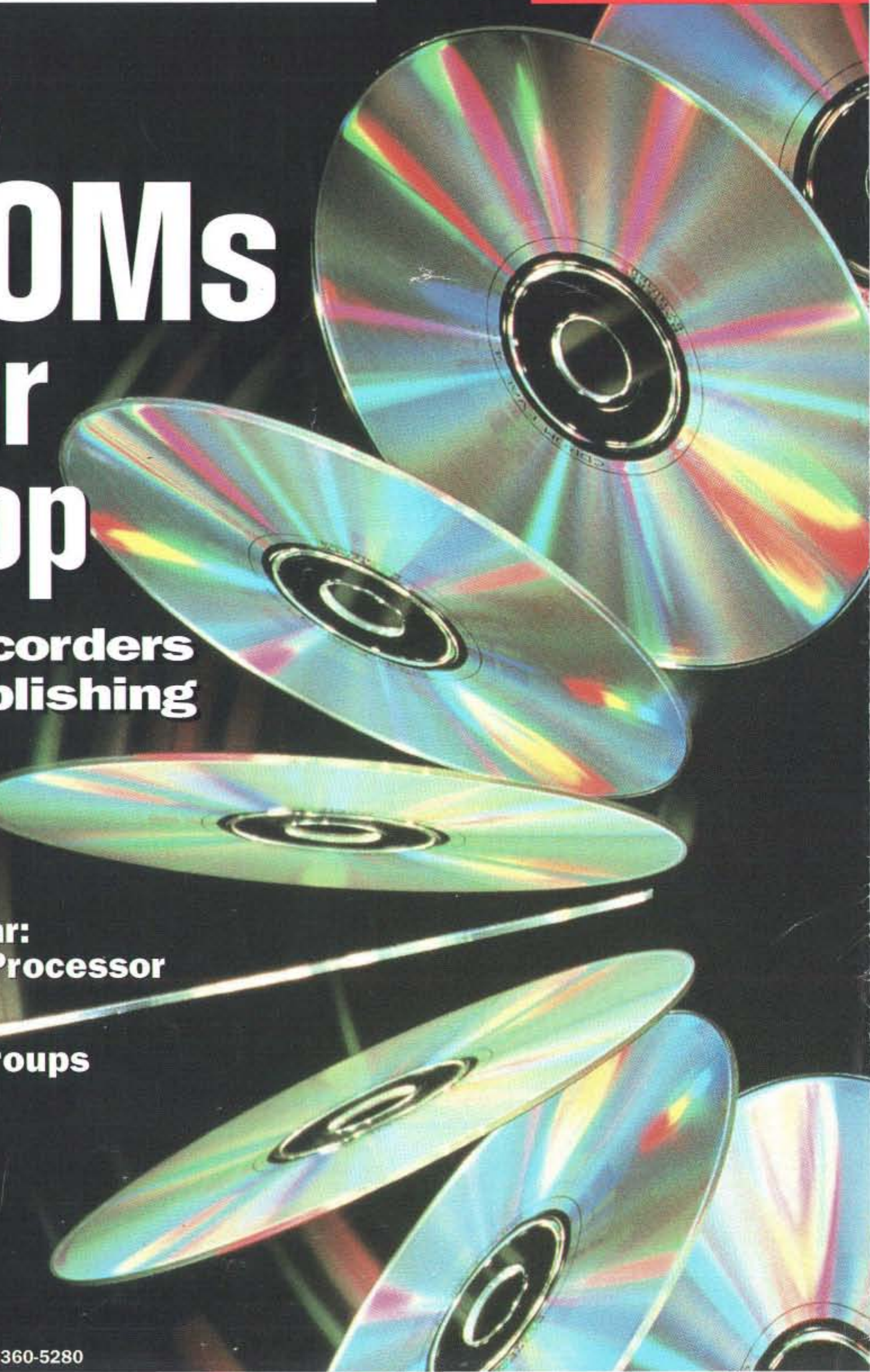
THE WORLDWIDE COMPUTING AUTHORITY

Wireless PCs Come of Age, Page 146

Create CD-ROMs on Your Desktop



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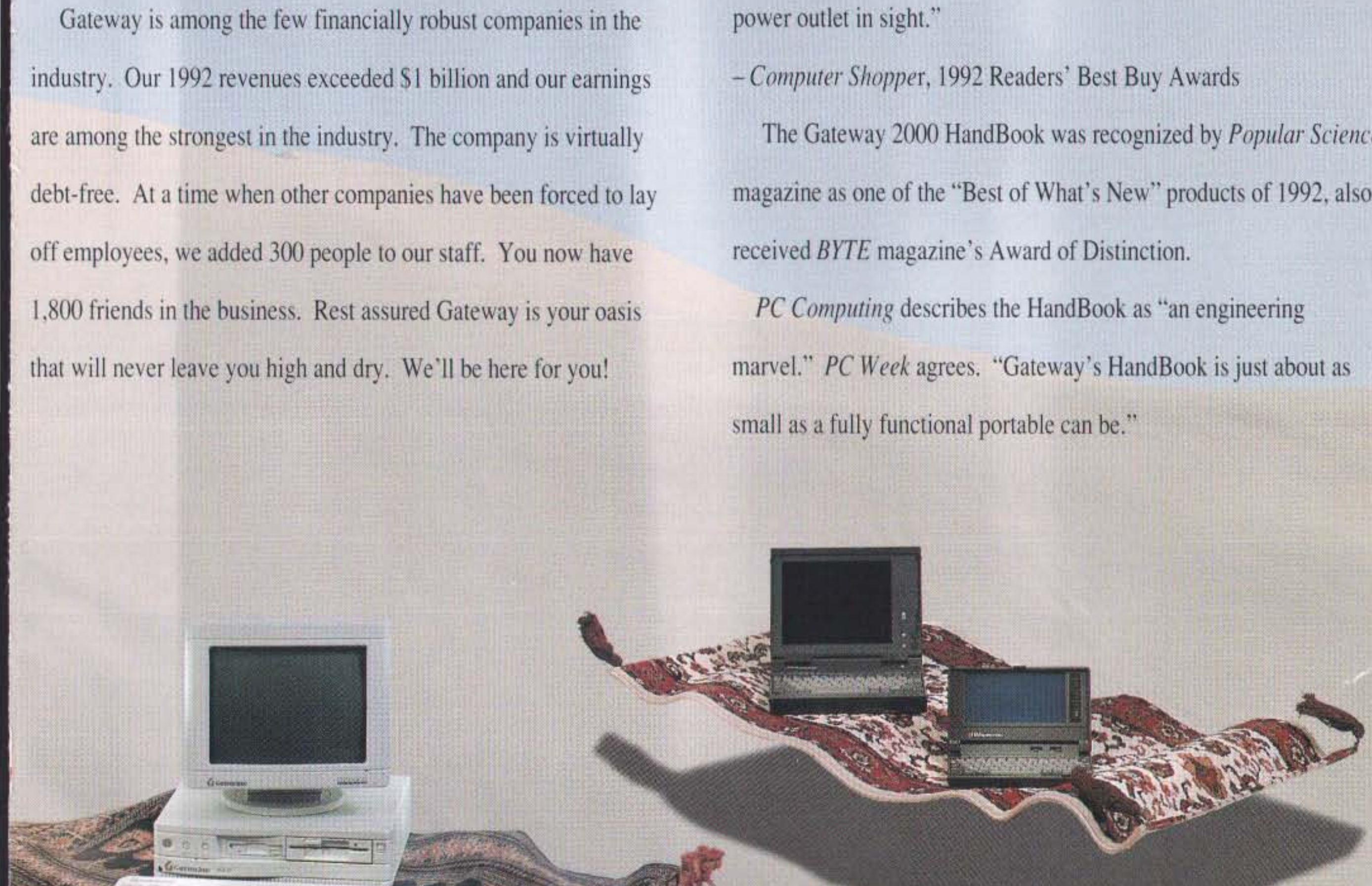
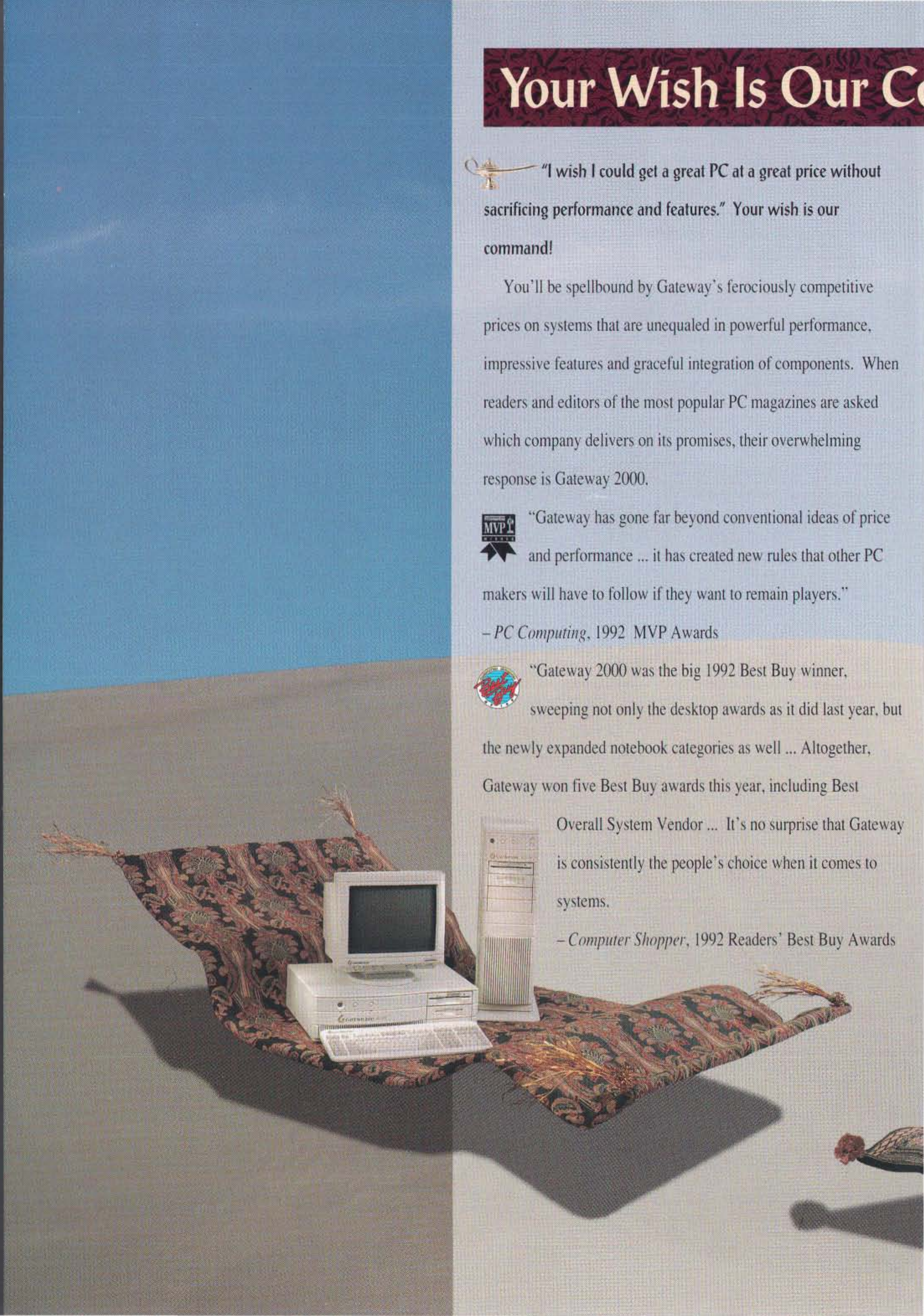
PC Computing describes the HandBook as "an engineering marvel." *PC Week* agrees. "Gateway's HandBook is just about as small as a fully functional portable can be."





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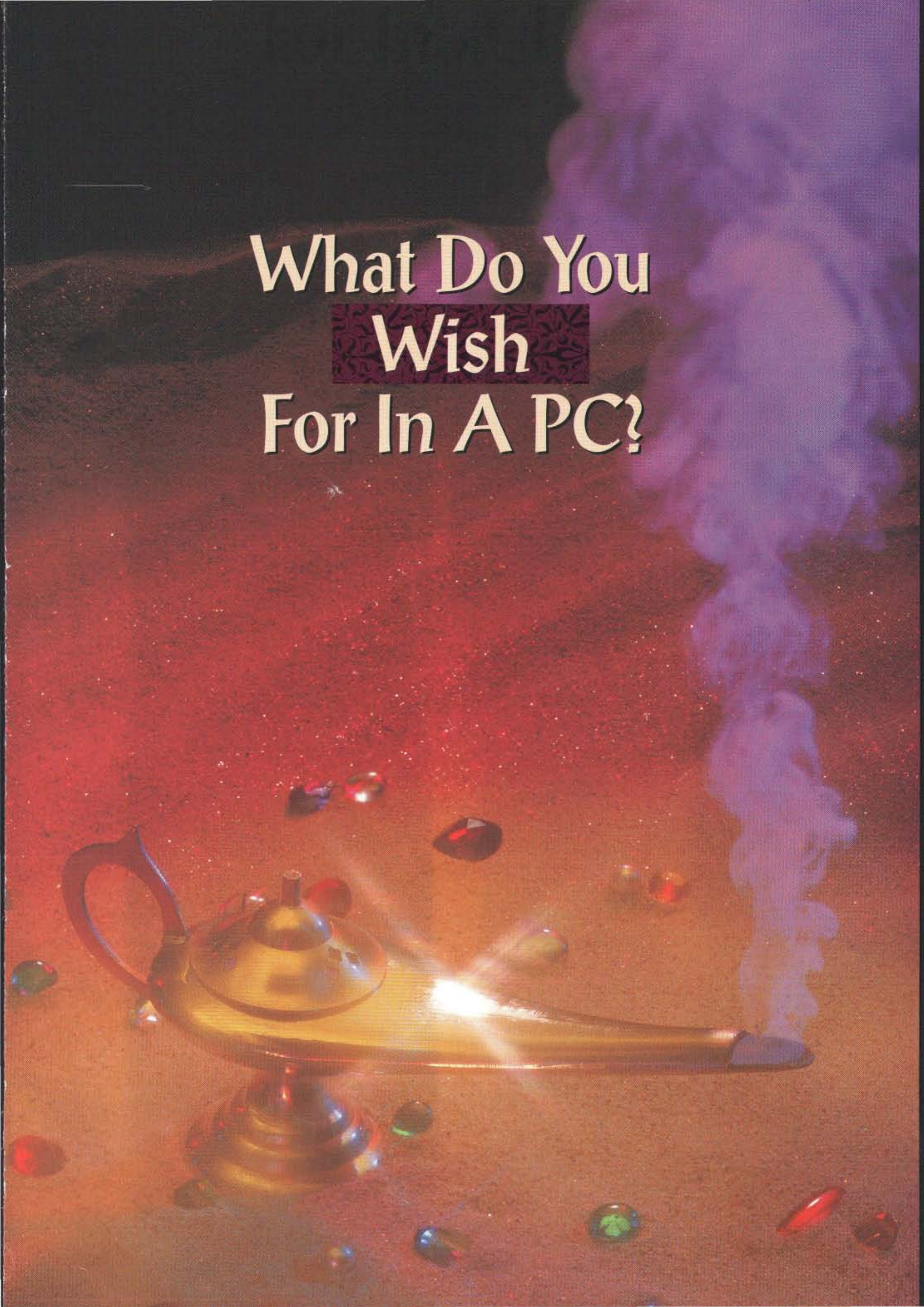
– *Computer Shopper*, 1992 Readers' Best Buy Awards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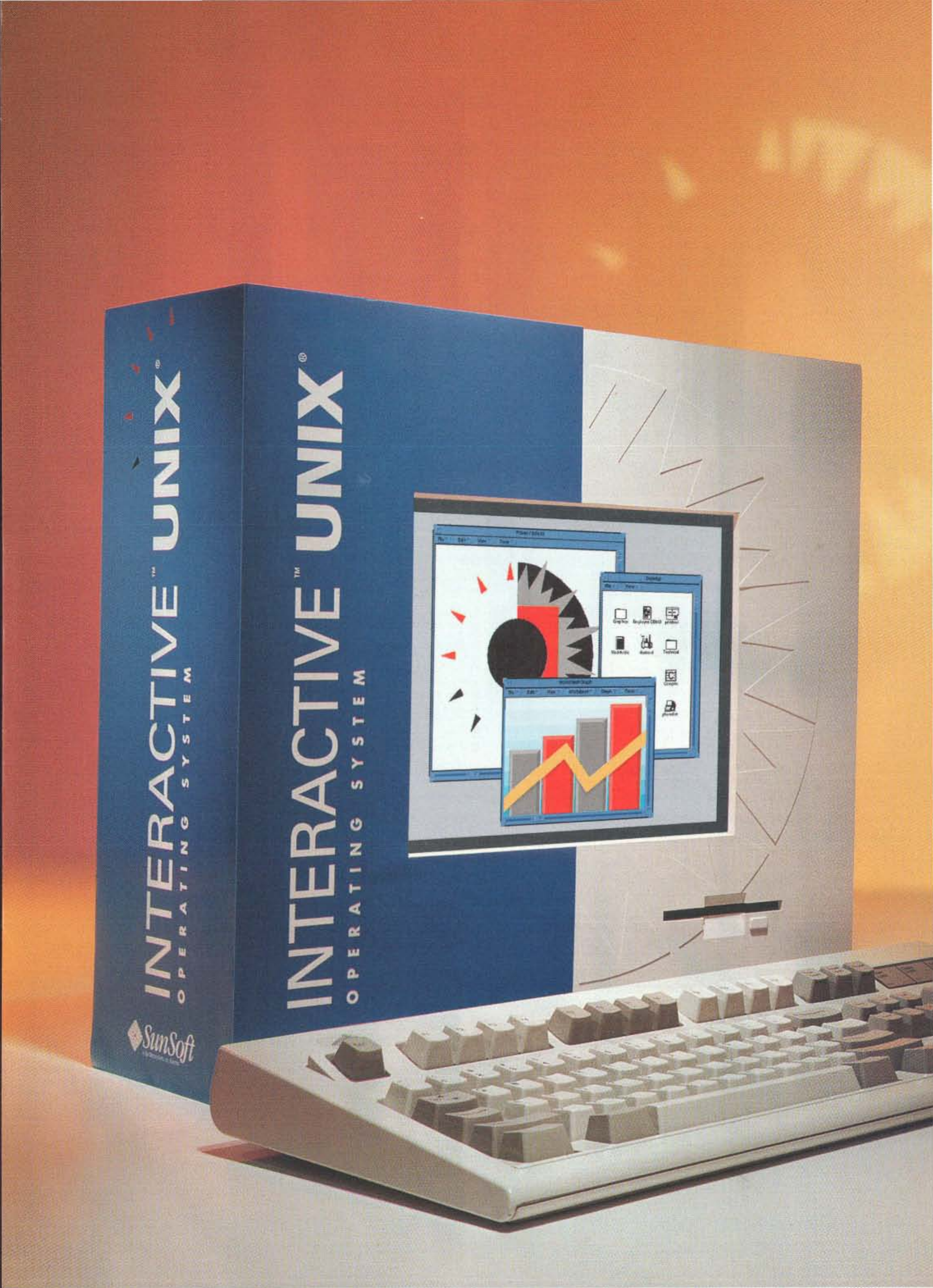
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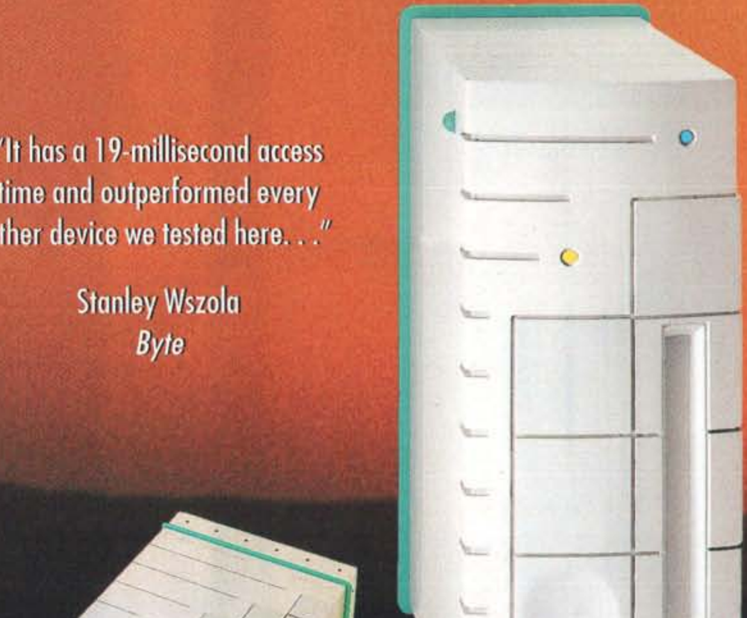

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ELAPSED TIME IN SECONDS					
Xcopy 20MB Tree to Optical Drive	135.3	506.5	440.6	198.1	477.5
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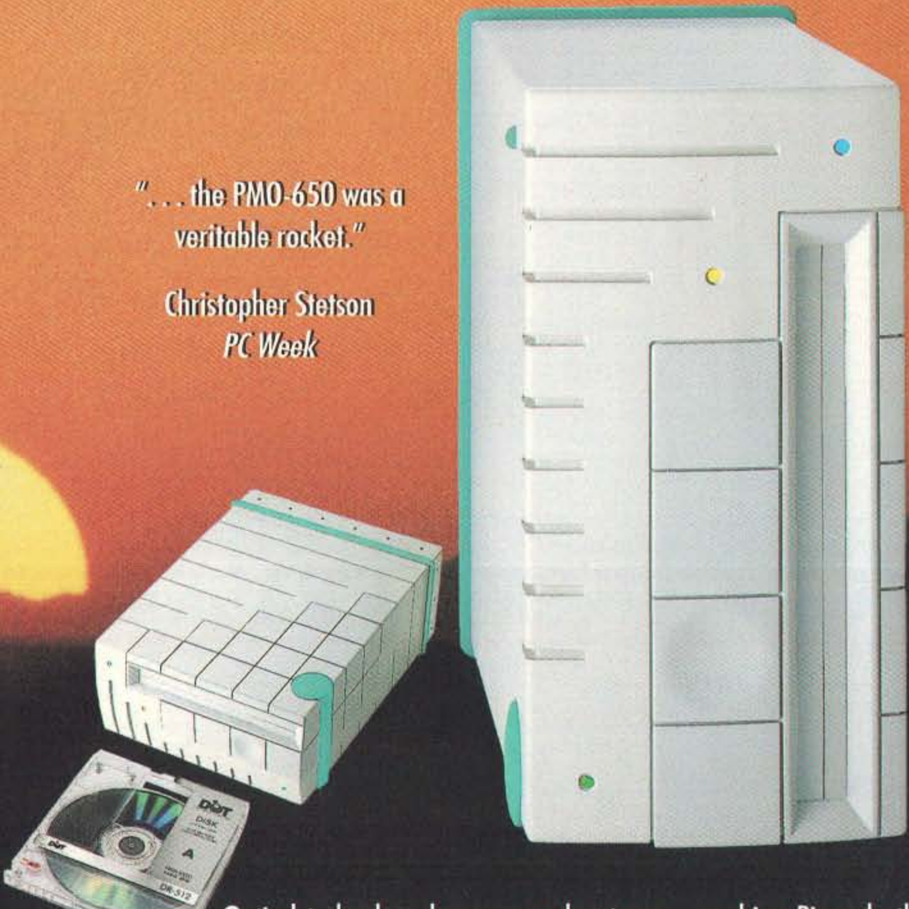

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INSIDE BYTE

BYTE Topic Index

This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 284), you can identify articles by type, subject, title, author, or product discussed.

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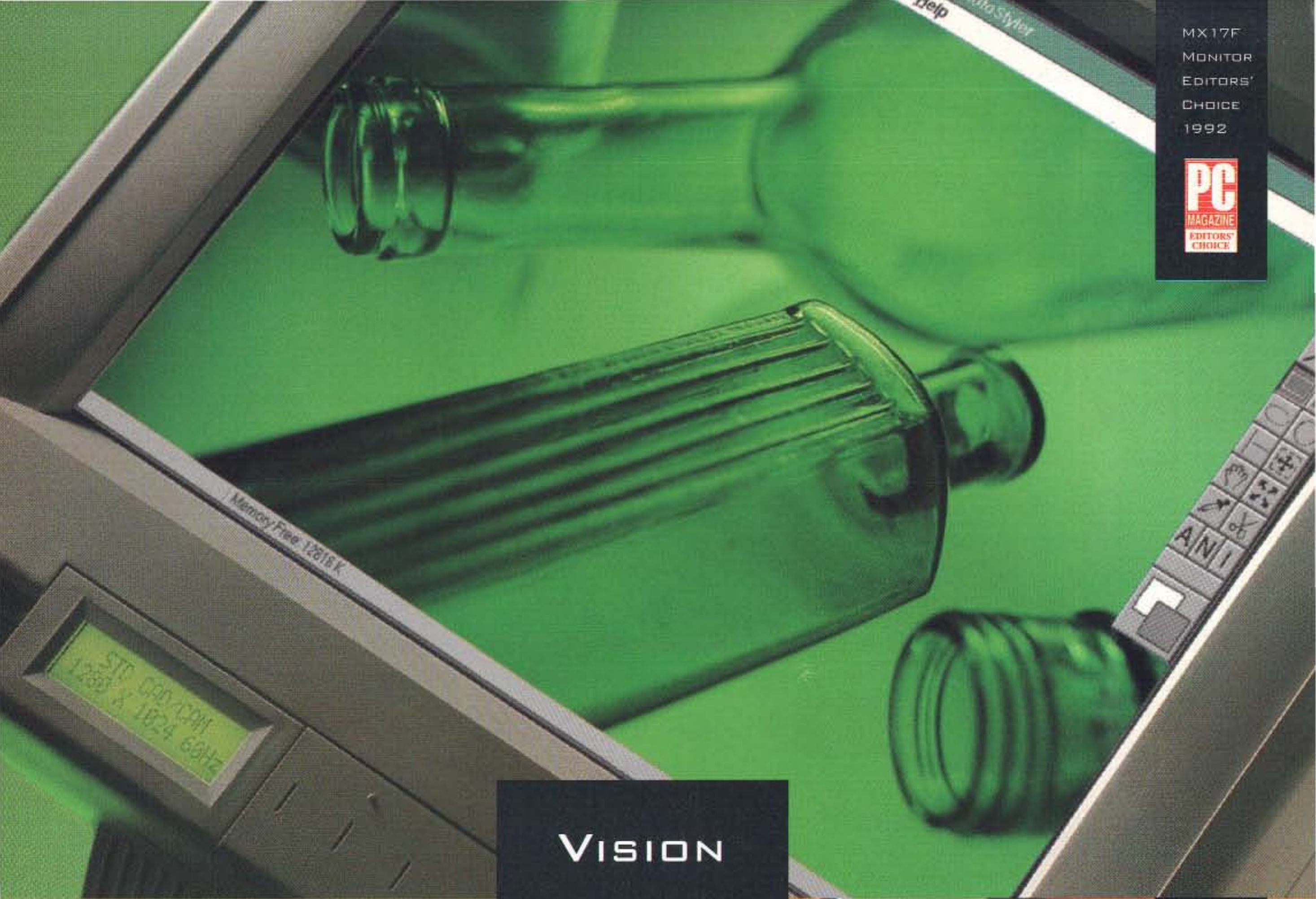

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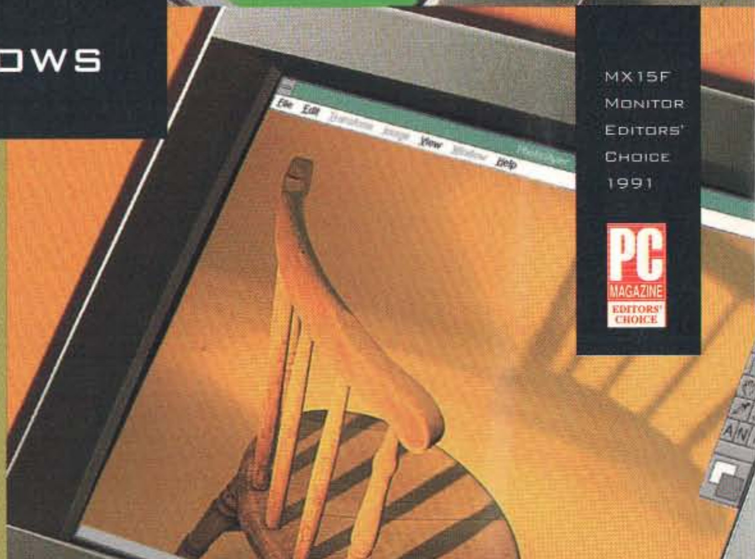

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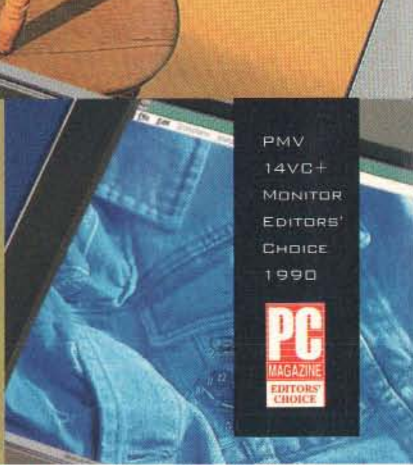

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486DX/33
Laptop Issue,
September 1992

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PC MAGAZINE

486DX/33
"Honorable mention"
August 1992

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December 1992 **PC Computing**

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EDITORIAL

DENNIS ALLEN

CD-ROM: NOW IS THE TIME

If you don't have a CD-ROM drive, buy one. For that matter, you ought to buy a CD-ROM drive for every personal computer in your organization, because something big is happening. The ability to create your own CD-ROMs on the desktop is every bit as revolutionary as was the Gutenberg press.

Until now, electronic publishing has been the domain of large organizations that had the dedicated staff to place information onto electronic media. Giant publishing houses have functioned like ancient monasteries, where countless scribes painstakingly penned information onto parchment. No one else had the wherewithal to do it.

With new CD-ROM recorders, you can deliver your information on a silver platter

Since the debut of CD-ROM, many folks have viewed electronic publishing with a jaundiced eye—a CD-ROM would be great, if only I could get *my* information on it. Now you can, with the arrival of CD-ROM recorders that sell for less than $8000. In other words, for about the price of an office photocopier, you can have a machine that produces CD-ROMs containing thousands of pages of information.

Think of the reference and archive documents you could place at the fingertips of the people in your organization. Better still, think of the library of CD-ROMs that could contain documents particular to your field and your company. Now think of that library sitting on everyone's desk for quick and easy access. If you have remote offices, you can send them weekly updates of your structured databases on CD-ROM. Moreover, people who work in the field could use that CD-ROM on their portable computers.

We're not talking infoglut, either. I'll bet you can't find an attorney who wouldn't like to have a searchable CD-ROM containing all the briefs ever filed by his or her firm. Neither could you find a single, solitary accountant or finance wizard who wouldn't want a company's budgets and expense details on a single CD-ROM. You probably know programmers who would give up their subscription to the *Microsoft Systems Journal* for a CD-ROM that had every object and program module ever written by their company's development staff.

There are as many possibilities as there are megabytes of information. Until now, though, storing that information on a network has been costly, using exotic and expensive jukebox optical systems. Even if you provide the information on the network, remote offices often can't get to that information.

Also consider the issue of dynamic information versus static. Not all information needs to be updated, and such static information shouldn't take up expensive writable media space. As for "live" information, not everyone needs update privileges. For these cases, it makes sense to publish on CD-ROM.

The only problem has been that CD-ROM mastering and duplicating costs have been high, especially if you needed only a few copies. Even then, there was no way to build a prototype CD-ROM with your information just to see how usable it might really be.

The advent of CD-ROM recorders for less than $8000 presents wonderfully new opportunities. For such a reasonable amount, and about $40 for the medium (a price that should drop rather quickly), your company can publish CD-ROMs on demand. The real strength of an organization lies in the ability of each individual to leverage the collective knowledge, and CD-ROM publishing is the tool that can allow that process to happen.

There is one catch, though. Most companies have not yet equipped all their systems with CD-ROM drives, and that has to be done. Fortunately, basic drives are available for as little as a couple of hundred dollars. Unfortunately, you will have to make some choices regarding CD-ROM formats, and our cover story this month ("Start the Presses," page 116) will help you with that.

Falling prices of systems should allow your 1993 budgets to cover that additional cost of CD-ROM drives in every new computer you buy. Keep in mind, too, that once you commit to CD-ROM drives for your company's internal information, you open the door to vast amounts of CD-ROM-based information from outside sources. In fact, you should expect the selection of CD-ROM material to grow significantly this year.

The point is that CD-ROM has come of age. It is unthinkable to not include CD-ROM in your strategic planning. And to the computer manufacturers who read this column, it is unconscionable to not include CD-ROM drives in new systems.

—Dennis Allen
Editor in Chief

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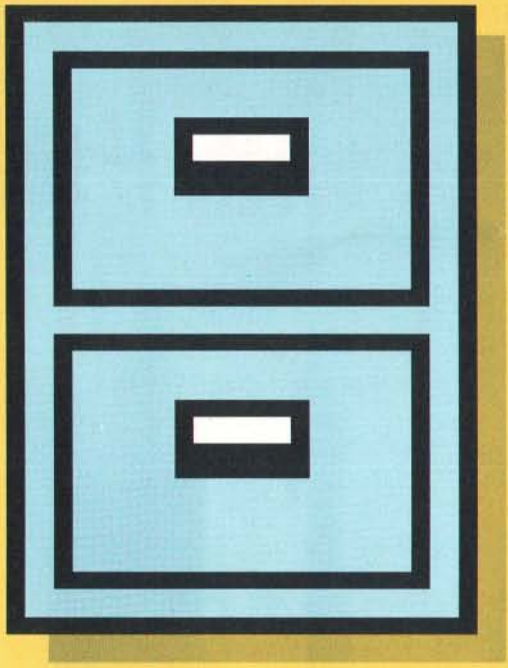

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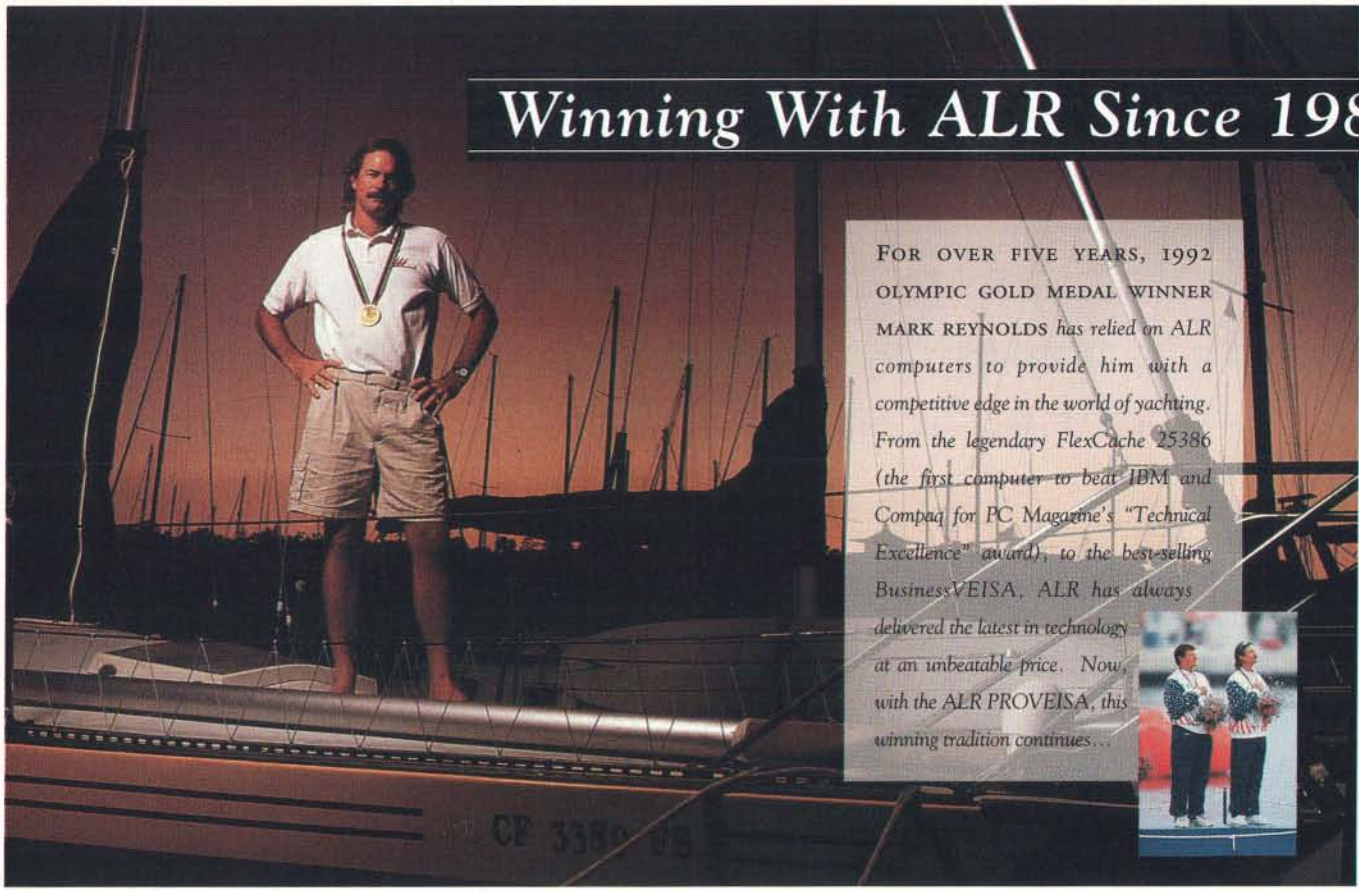

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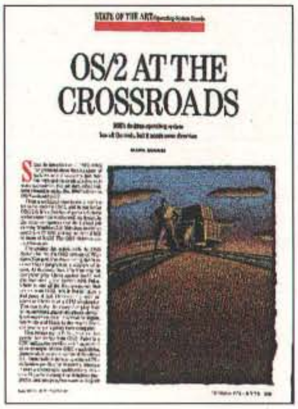

STATE OF THE ART

OS/2 AT THE CROSSROADS

Operating Systems in Depth

Regarding the October 1992 State of the Art section on operating systems, I am slightly confused as to why the authors keep comparing IBM's OS/2 to Microsoft's Windows NT. Windows NT is not aimed at the average computer user but toward high-end servers. OS/2, on the other hand, is aimed at the average user.

Johan Hellman
Stockholm, Sweden

In "OS/2 at the Crossroads" (October 1992), Mark Minasi says OS/2 2.0 is doing "in a word, badly." Elsewhere in that issue, Steve Mastrianni says, "Interest in OS/2 2.0 is growing by leaps and bounds" ("OS/2 2.0 Programming Tools Arrive—Finally"), and "[tool] vendors, noting the overwhelming response to OS/2 2.0, have announced products or plan to release products...." It's great to see that BYTE permits differing opinions.

Then in the State of the Art Resource Guide, which lists companies that have announced support for OS/2 2.0, Microsoft is listed. Is this a test to see if we're paying attention?

Bill Zinsmeyer
CompuServe address: 70324.64

Mark Minasi's "OS/2 at the Crossroads" is the first article I've found that accurately reflects the feel and experience of using OS/2 2.0. Other articles have reflected the authors' newness to OS/2 2.0's Workplace Shell or have used Windows as the standard by which to judge OS/2 2.0.

Keep up the reporting on OS/2.

Dave Werner
Hong Kong

In the Resource Guide to the October 1992 State of the Art section on operating-system trends, The Periscope Co., which sells Periscope/32 for OS/2, is incorrectly listed in the Windows NT section. We should be in the OS/2 2.0 section.

Also, in "OS/2 2.0 Programming Tools Arrive—Finally," Steve Mastrianni says he doubts that you'll need more debugging tools than the ones IBM provides. The IBM kernel debugger is somewhat useful, but it has no source-level support and very limited symbolic support. In addition, it is hard to use and has a TTY-type serial interface. Periscope/32 for OS/2 supports full-screen source-level and symbolic debugging, and it has a user-friendly interface.

Dan Navarra
Director of Sales and Marketing
The Periscope Co., Inc.
Atlanta, GA

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Digital Photography

The article "Smile for the Computer" (November 1992) was informative but missed one important application for digital photography.

I produce training materials, often on technically demanding topics such as advanced manufacturing equipment. Using Digital Vision's ComputerEyes/RT board, along with a standard VHS video signal, I capture images. I import a bit-mapped image into a vector-based illustrating package, such as Micrografx Designer, and use it as a template to overlay a line drawing of the image. I then add text, fills, shading, and gradients as needed and delete the bit map.

This technique allows for the development of very accurate drawings of complicated subject matter quickly and without a tremendous amount of artistic interpretation. It also produces better results on low-end printers than if I used the bit maps directly. And the file sizes of the line drawings are much smaller than the bit maps they replace.

James Barfield
St. Ann, MO

A20 Revisited

Charles Bretana Jr.'s letter "A20 Issues" (November 1992), which responds to Mark J. Minasi's "Exorcising the A20 Poltergeist" (August 1992), contains a substantial error. The 386SX truly has only 24 address lines. Bretana's comment that the 386 extended mode requires access to a 4-GB address space confuses virtual memory with physical memory.

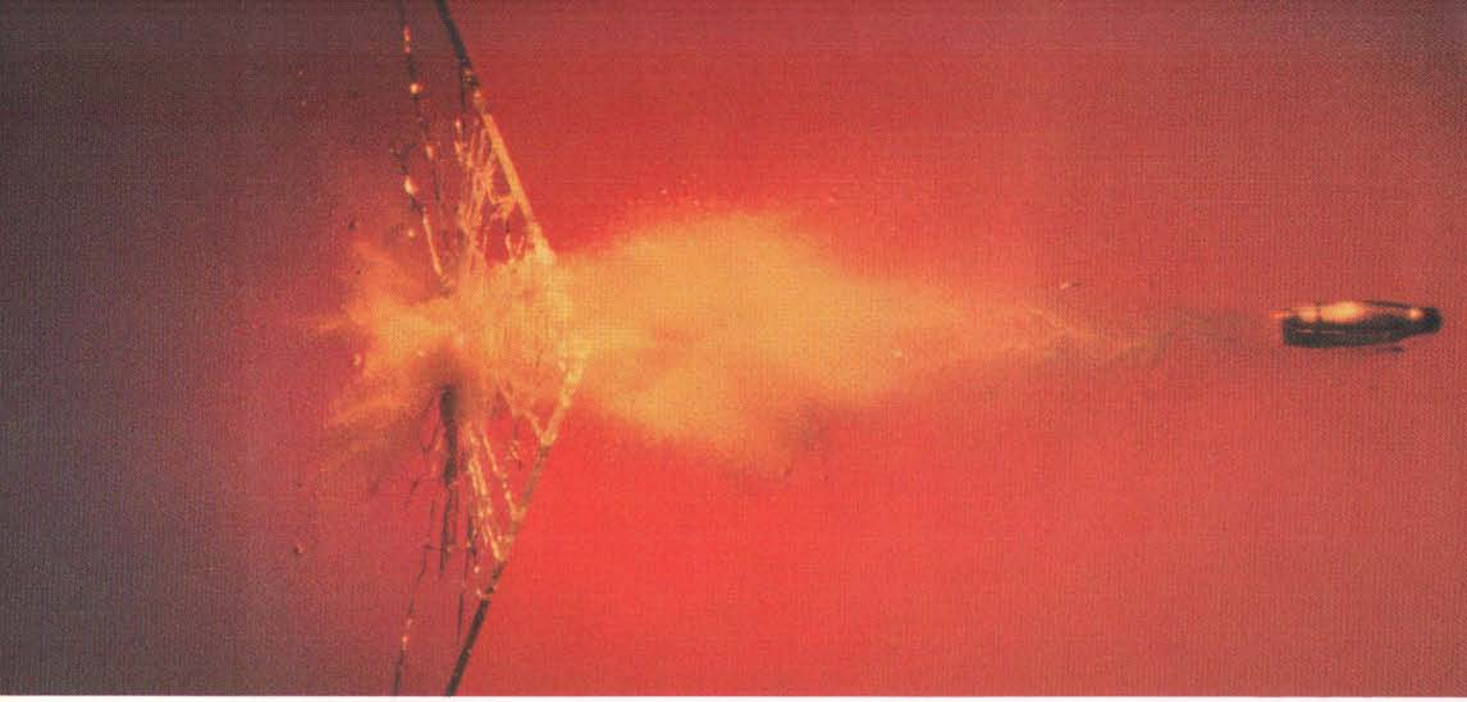
Andrew Klossner
Wilsonville, OR

You're right, but Bretana brings up an interesting point. Unfortunately, my response didn't make it into the November 1992 issue. Briefly, the internal memory registers on the 386 family are 32 bits wide, enabling the 386SL and 386SX to use the 386 protected mode on which Bretana originally commented. However, Intel wanted the 386SL and 386SX to displace the 286, so those chips have only 24 physical address lines. From a hardware point of view, there are 24 address lines; from a software point of view, there are 32.—Mark J. Minasi

The Ultimate Workstation

I was disappointed by your choice of an entry-level Nextstation in "Stalking the Ultimate Workstation" (November 1992). Considering the relative prices of other machines in the test, a Nextstation Turbo Color (with a 33-MHz 68030 CPU, 16 MB of RAM, a 400-MB hard drive, and a 21-inch color display) would have been a more telling comparison. Such a system sells for under $11,000 and would have fared better in the benchmarks.

Ben VonZastrow
Oakland, CA



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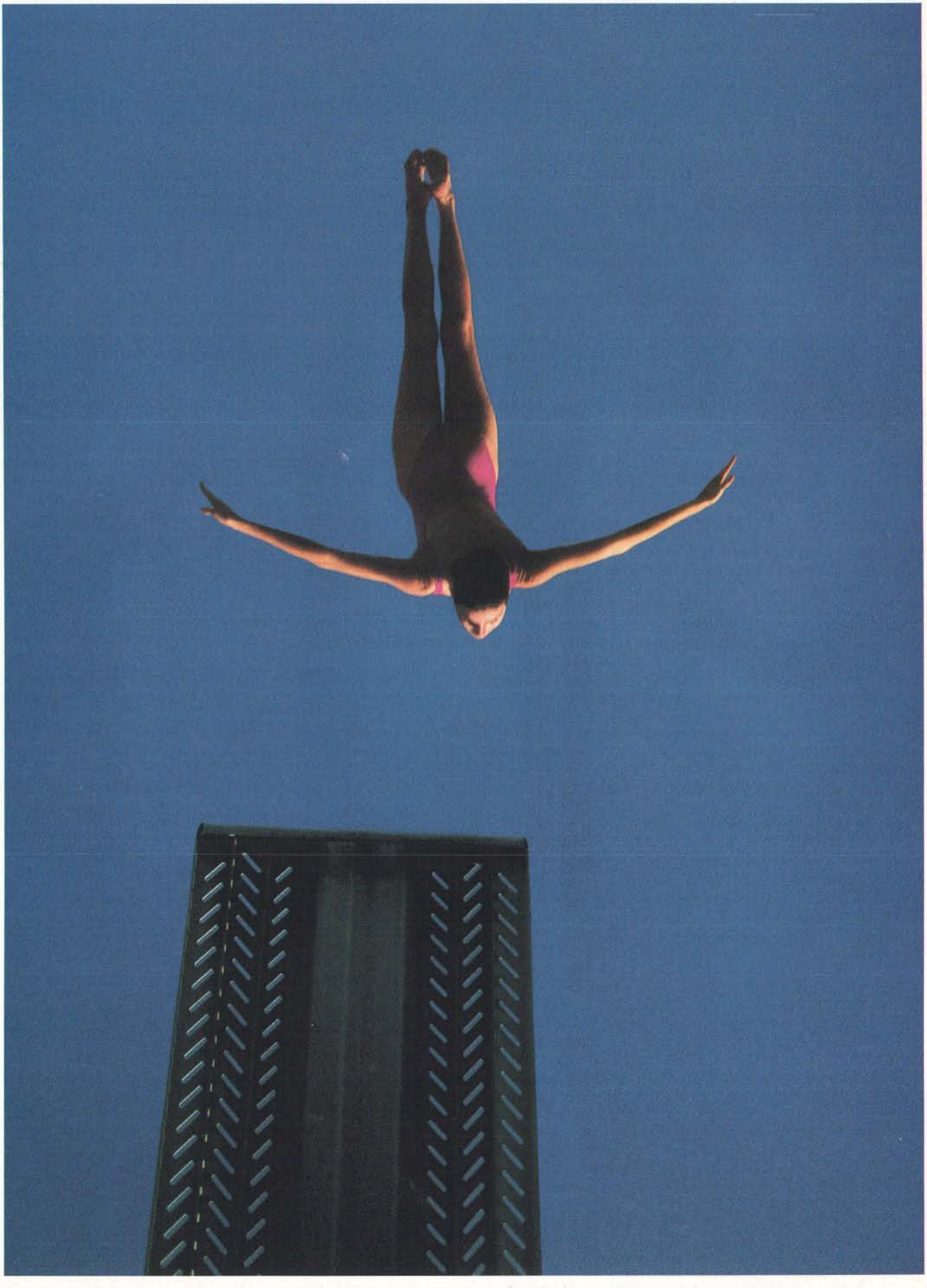

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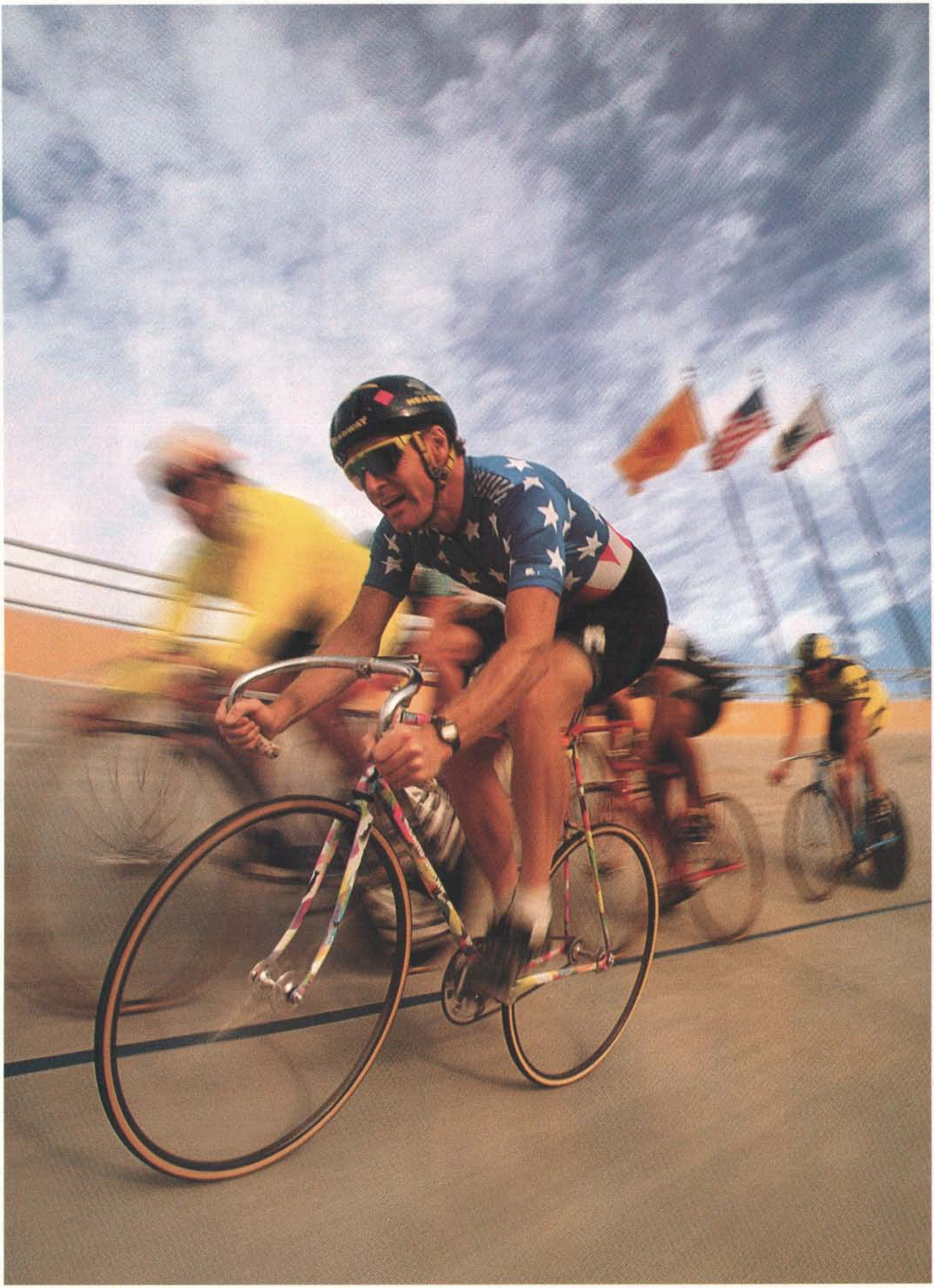
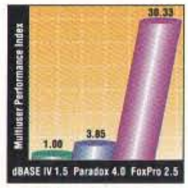


Since the beginning of time, people have been obsessed with reaching ever increasing rates of speed. So what else is new with Microsoft FoxPro 2.5?



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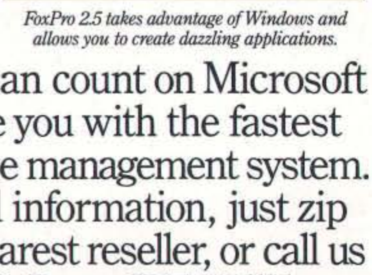

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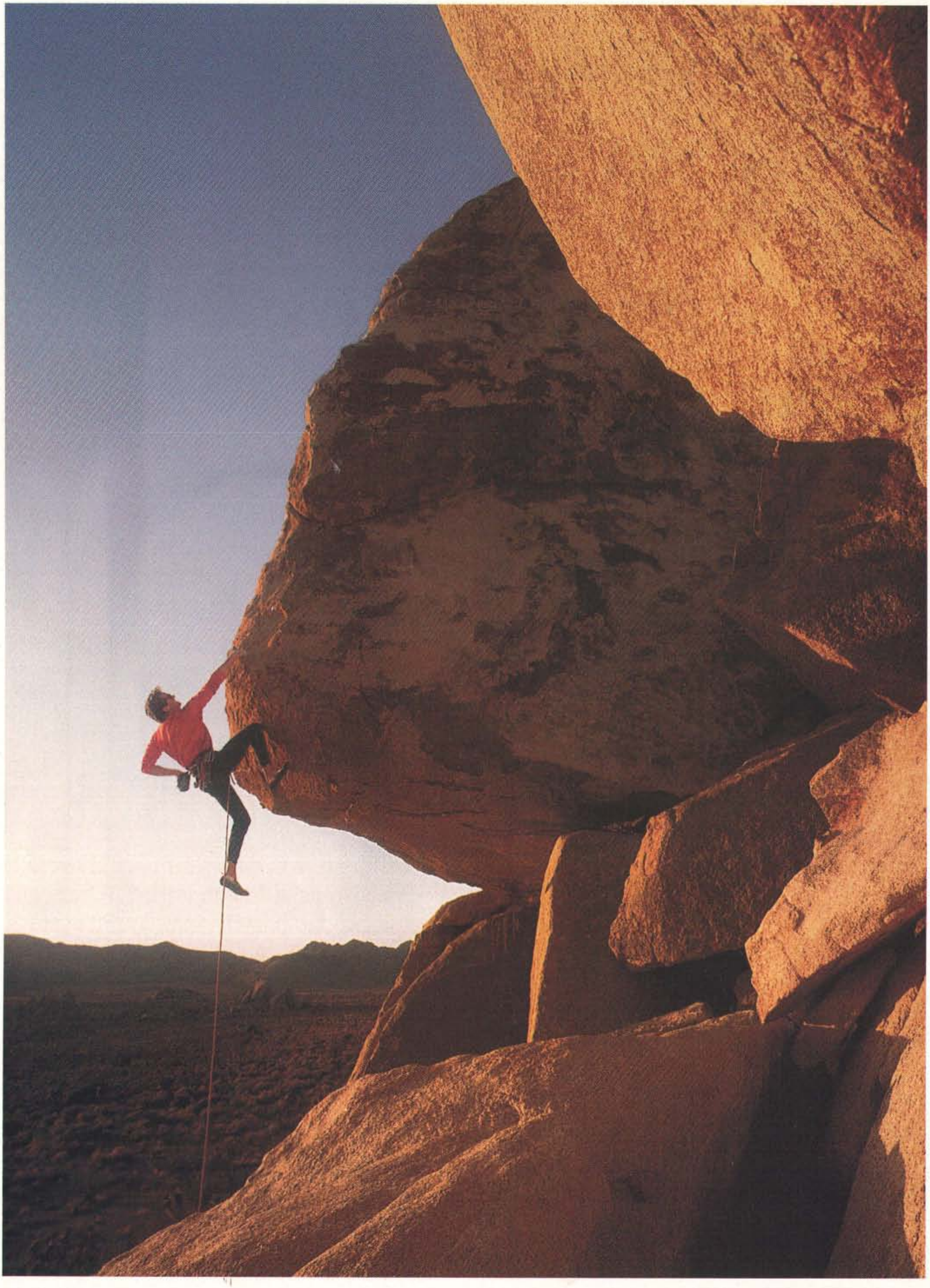

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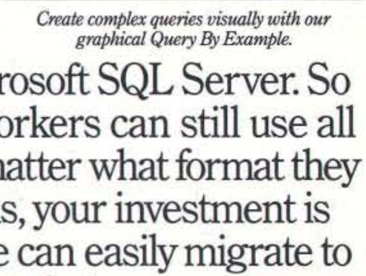

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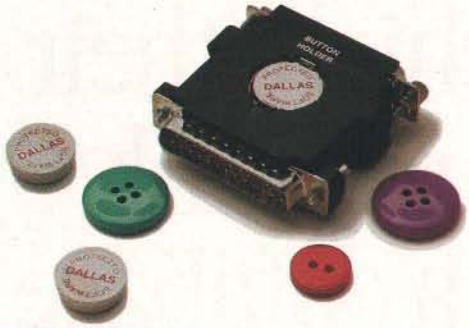

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LETTERS

I am concerned about the absurd comparisons made in your "Stalking the Ultimate Workstation" review. Ben Smith and Raymond GA Côté did a disservice to your readers by comparing the least powerful Next computer to other, much more expensive and fully configured computers. They should have tested the Nextstation Turbo Color or the Nextdimension systems. These are much faster machines, and they would have been less expensive than most of the computers tested.

Eric M. Hall
San Francisco, CA

We received many letters about our "Stalking the Ultimate Workstation" review. Most came from Next enthusiasts whose main criticism was that we didn't compare a more powerful Nextstation against the higher-performance (and more expensive) workstations from other vendors.

It's important to note that none of the other machines were fully configured or optimized, either. And performance didn't always win out. IBM's RISC System/6000 exceeded in raw performance, but it scored low for its user interface and cost.

It's impossible to perform a scientific comparison of systems that have different CPUs, operating systems, and user interfaces. The only way to evaluate this spectrum is to call them as we see them, and that's what we did.

Thanks for your letters.—Ben Smith

FIXES

- In the Ask BYTE section (see "BYTE on UUNET," November 1992), the address given for FTP access to UUNET is incorrect. The correct address is ftp.uu.net. You should then log on as "anonymous" and use your user ID (i.e., "userid@host") as your password.
- David Giller's letter ("Unix for Nothing," November 1992) on Linux contains the correct FTP address but the wrong case syntax. The FTP address should read nic.funet.fi:/pub/OS/Linux.
- In "Style Meets Substance in Matrox Studio" (November 1992), the price for the Matrox Studio package is incorrectly quoted at $14,000. The correct price is $15,995.
- Compaq's color notebook computer is incorrectly referenced as the Compaq LTE 386 Lite/25 in "BYTE's Essential Guide to Notebook PCs" (*BYTE's Essential Guide to Portable Computing*, 1992). The correct name is the Compaq LTE/Lite 25C. Also, in the same issue, the text box "Portable Fax Software Rated for DOS and Windows" on page 52 contains a misleading statement about Eclipse Software's Eclipse Fax. In most cases, Eclipse Fax performs true manual receive. The author was referring to manual receive attempts made through a hotel switchboard when he stated otherwise. For more details on Eclipse Fax, see "Forging a Business Tool: Three Fax Software Packages for Windows" on page 209.
- In *BYTE's Essential Guide to Windows*, 1992, we incorrectly identified XTree Co.'s product as XTree Gold for Windows. The correct product name is XTree for Windows. The address is 4115 Broad St., Building 1, San Luis Obispo, CA 93401. ■

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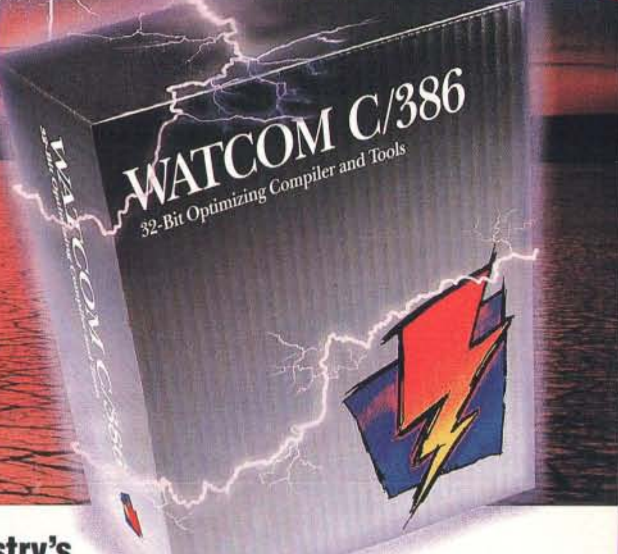

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Lotus, *David Reed, Chief Scientist and Vice President, Pen-Based Applications:* "In new product development we're working with WATCOM C because of superior code optimization, responsive support, and timely delivery of technologies important to us like p-code and support for GO Corp's. PenPoint."

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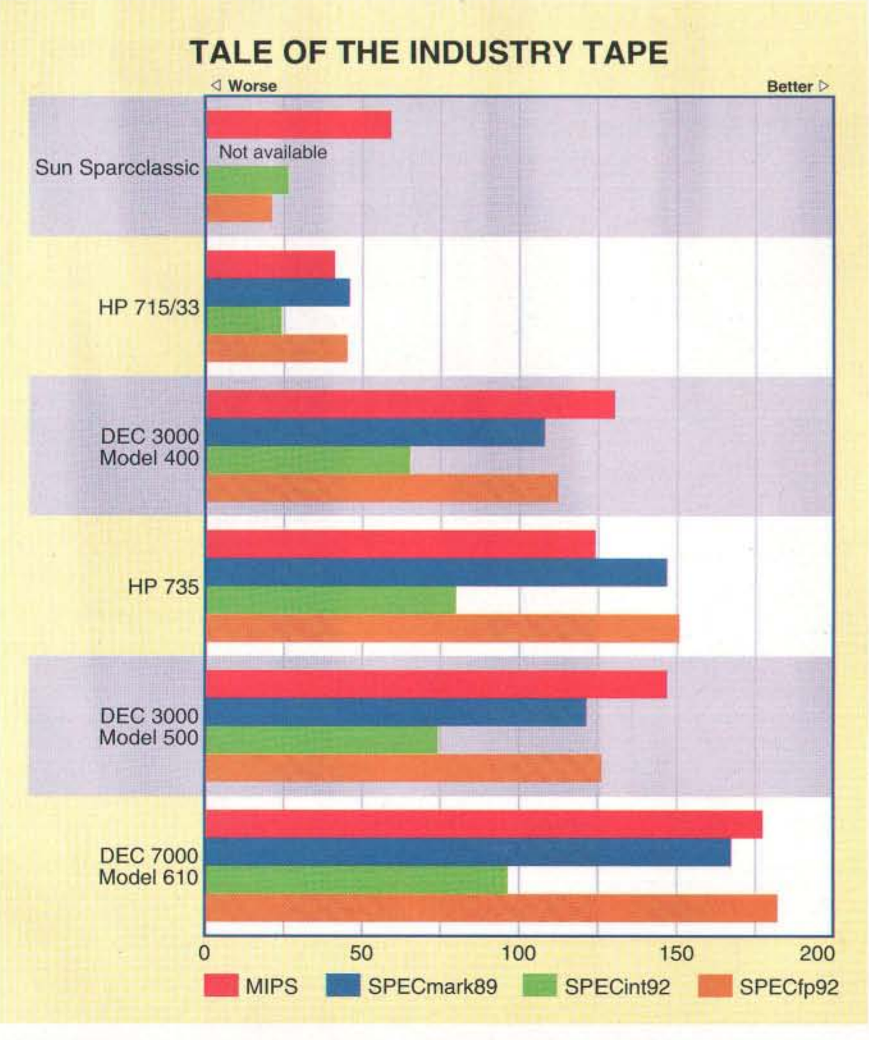
NEWS

MICROBYTES

Battle of the Workstation Stars

It was a Super Tuesday in November for Unix workstations as three arch rivals—Sun Microsystems, Hewlett-Packard's workstation systems group, and DEC—unveiled several systems built around new high-power CPUs. Sun staked a claim in the low-end workstation turf by unveiling workstations based on the low-priced RISC microSparc microprocessor. HP's workstation systems group based in Chelmsford, Massachusetts, took jabs at DEC, IBM, Silicon Graphics, and Sun with systems based on the single-chip Precision 7100 processor. In addition, DEC introduced the first of its Alpha AXP workstations based on 64-bit RISC technology.

Only Sun's Sparcclassic and Sparcstation LX and DEC's Alpha AXP workstations running Open VMS AXP were shipping in volume as of last December. The other workstations are slated to ship in the first quarter of this year. DEC also plans to



SPECmark89 measures CPU-intensive, single-stream performance. SPECint92 and SPECfp92 measure CPU and FPU performance, respectively. MIPS ratings are based on the Dhrystone 1.1 benchmark. Higher numbers are better.

NANOBYTES

Portable workstation developer **Tadpole Technology** (Cambridge, U.K., and Austin, TX) says it will make notebook workstations based on the PowerPC 601 RISC processor being designed by IBM and Motorola. Under terms of an agreement that at press time was contingent on the completion of equity negotiations between the two companies, Tadpole will develop and IBM will market the notebooks. ☐

"Multimedia for business, government, and education is in its adolescence, but for the home, it's very much in its infancy," says **Mike Braun**, IBM's assistant general manager for multimedia. In Braun's view, the home offers two potential "spaces" of interest: the living room (entertainment) and the den (computers). Commodore's CDTV, Philips' CD-I (Compact Disc Interactive), and Tandy's VIS are "aimed at the living room," Braun says, but "they're not making it, and they won't make it." The reason? "People expect something at least as good as TV or in the price range of Nintendo, but these are in the middle," he explains. ☐

The mainframe as a multimedia server? At Comdex, IBM had an ES-9000 mainframe and showed various full-motion video applications running across network and T1 leased-line connections to Dallas, Texas; Raleigh, North Carolina; and Chicago. IBM also rolled out **UltiMotion**, its software solution for delivering full-motion video and audio on a computer. ☐

Advanced Signal Processing *(ASP) delivers 4:1 realtime hardware data compression and saves up to 65% of CPU processing time.*

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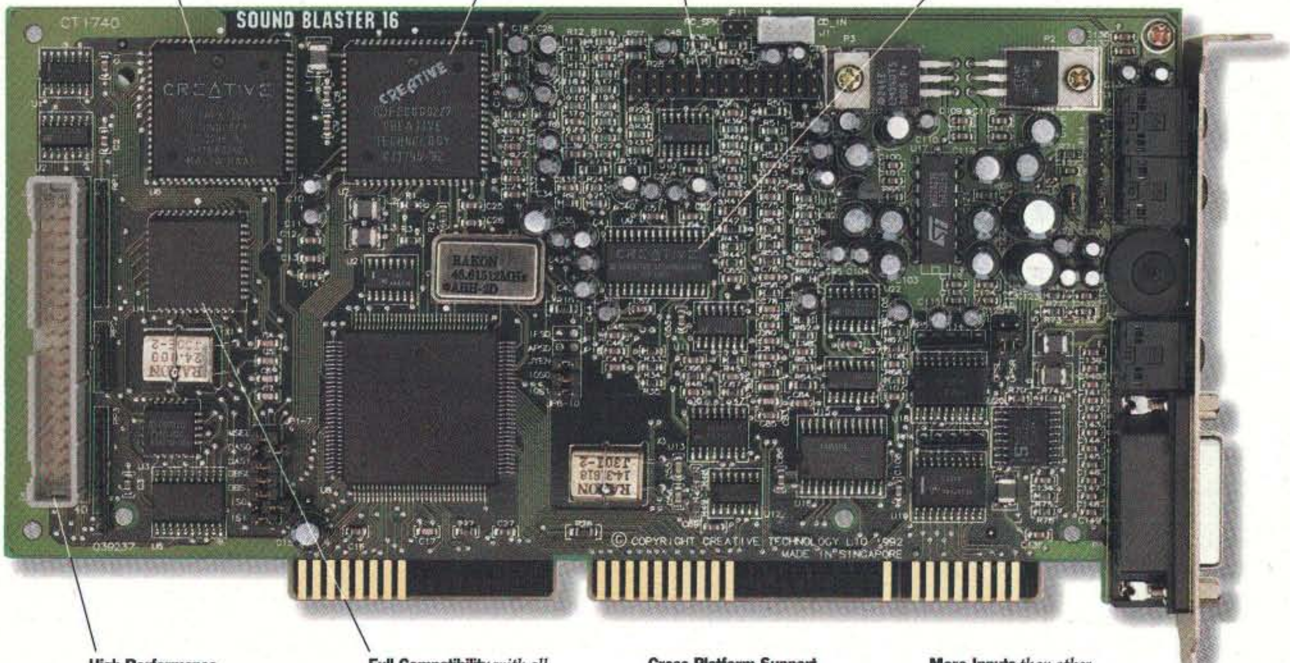

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release this spring what William Demmer, vice president of Alpha and VAX systems, describes as "the world's fastest Windows machine." DEC officials said the system will run Windows NT and will be priced competitively with Intel 486 machines.

Low Sun on the Horizon

Sun's two SPARC-compatible workstations and a server cost about the same as high-end 486-based PCs but offer superior performance. All three Sun machines use the new RISC-based microSparc processor (for more details on the microSparc, see "Coming Soon: Sparc Workstations at PC Prices," December 1992 BYTE, page 30). At $4295, the Sparcclassic is (for now, at least) the lowest-priced color workstation available. In quantities of 12, it costs even less: $3995. The Sparcclassic is not a barebones system. It includes 16 MB of RAM (expandable to 96 MB), a 207-MB hard drive, a 15-inch color monitor, a full array of I/O interfaces, and Sun's Solaris 2.1 and the Open Look GUI.

Until Pentium-based machines become available, the Sparcclassic should be capable of outrunning the fastest PCs. Sun says a final production version of the 50-MHz microSparc executes 59 MIPS. A 66-MHz 486DX2 delivers about 54 MIPS. While the microSparc costs only $179 in production quantities, the fastest 486DX chips cost more than $500. Sun hints that faster versions of the microSparc are on the way. Sun's other microSparc workstation is the Sparcstation LX, billed as the lowest-priced ($7995) accelerated graphics computer on the market. The $5295 Sparcclassic server is similar to the Sparcclassic, but the server comes with a 1-GB hard drive.

HP Spreads Out

All the new HP systems are based on the company's Precision 7100 processor, which Robert Weinberger, manager of product marketing at HP's workstation systems group, said is "the first implementation of PA-RISC that is fully superscalar, capable of dispatching and executing two instructions per cycle." The 7100 includes an integrated FPU.

At the high end, HP introduced the Model 735 (starts at $34,795) and the Model 755 (starts at $58,995) workstations. Both systems run on the 99-MHz 7100 processor and run HP-UX 9.0. Graphics options range from eight-plane gray-scale (GRX) to 24-plane accelerated, double-buffered color (CRX-48Z).

At the low end (prices start at $4995; prices for color versions start at $5695), HP announced the Model 715, which uses a 33-MHz version of the 7100; a 50-MHz version is also available ($11,895). HP also announced its desktop Model 725, which runs at 50 MHz and can function as a server due to four EISA slots ($17,895). HP says that, except for the CRX-48Z, all its graphics options will be available up and down the new workstation line so that it can compete head-on with Silicon Graphics.

A New Start for DEC

DEC officials pulled no punches in reiterating that the Alpha rollout was more than a new product announcement. DEC announced two Alpha AXP–based workstations and five servers that will run Open VMS AXP and, when available, DEC's 64-bit OSF/1 for Alpha AXP and Microsoft's Windows NT operating systems. All systems are based on the DECchip 21064 processor. DEC is working to protect its existing customer base by providing native compilers and binary translators for moving Open VMS VAX applications to the Open VMS AXP 1.0 operating system.

As applications areas such as multimedia, imaging, and virtual reality move forward, 64-bit addressing will help those applications reach their potential, said Demmer. DEC promises that the 64-bit OSF/1 for Alpha AXP will run applications written to popular Unix variants such as System V, OSF, and Berkeley derivatives.

Heading up the Alpha AXP lineup is the DEC 3000 Model 400 AXP at $14,995. The DEC 3000 Model 500 AXP workstation ($38,995) runs on a 150-MHz processor. On the server side, DEC announced the 133-MHz DEC 3000 Model 400S AXP system ($18,995) and the 150-MHz DEC 3000 Model 500S AXP ($41,195) deskside system. The DEC 4000 Models 610 and 620 AXP distributed/departmental systems are available in single- and dual-processor symmetric multiprocessing configurations. Dual 160-MHz processor configurations provide 247 SPECthruput89 performance, DEC says. Single-processor DEC 4000 systems start at $77,000. The DEC 7000 data center is available with up to six 182-MHz processors.

Although system performance is important (see the figure), the success of DEC, HP, and Sun will not be determined solely on the basis of MIPS and SPECmarks. To substantially increase their sales, the companies will have to market their systems as not only fast but also supported by a wide range of applications.

—Dan Muse, Tom Halfhill, and Dave Andrews

NANOBYTES

Cyrix (Richardson, TX) says it plans to bring its second 486 socket–compatible CPU to market by June. The chip is code-named the **M7**. The **Cx486S2/50**, Cyrix's new 486SX compatible, is sampling now and is expected to reach volume availability by March. Targeted at the 486SX market segment—particularly Intel's 33-MHz 486SX—the Cx486S2/50 runs at 50 MHz internally and 25 MHz externally. Unlike the future M7 chip, which Cyrix says will have an integrated FPU, the Cx486S2/50 requires a separate FPU module. The Cx486S2/50 uses an on-board write-back cache, eight write buffers, and burst writes to cut down on CPU bus traffic. Cyrix plans to sell the chip for $249 in quantity, or about $60 more than Intel's 486SX/33. ☐

The latest word from **Watcom**, which is beta testing a Pentium optimizing compiler, confirms that to get the true performance out of Intel's next-generation chip, you need to optimize code. David Boswell, spokesman for the Waterloo, Ontario–based company, said, "We're beta testing our Pentium compilers with various ISVs [independent software vendors] who have the kind of applications that need a lot of cycles. The results are really encouraging." Boswell said Watcom used its best compiler that's now shipping retail, compiled an application, and ran it on a Pentium-based system. It then used the special Pentium optimizing compiler to run it on the same system. "Compiling the same app, you sure notice a dramatic improvement from those Pentium optimizations," he said. ☐

Microsoft is developing a smart forms-routing program code-named **Calvin and Hobbes** for Windows for Workgroups, sources said. Sources also said the company is working on a small-business accounting program for Windows, code-named Boris. ☐

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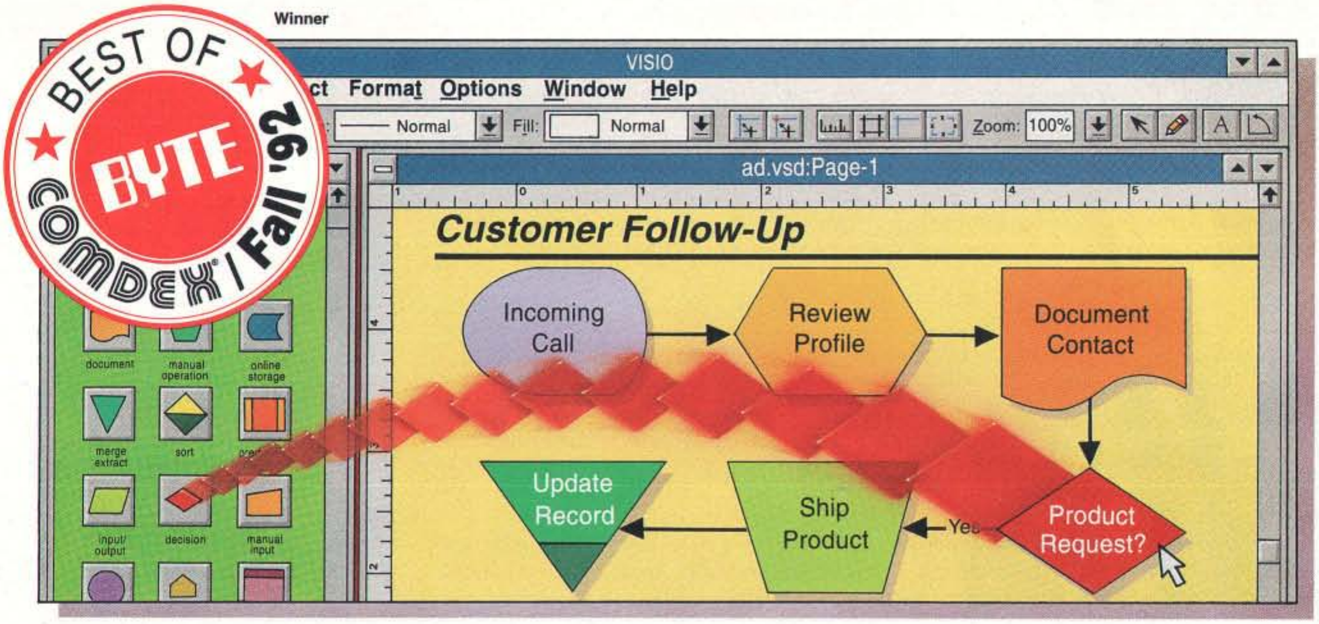

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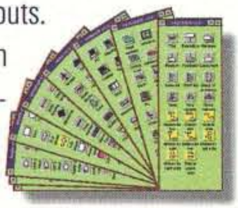

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NEWS

MICROBYTES

AMD vs. Intel: Back to the Breadboard

After losing a key court decision on its use of Intel microcode in future chip designs, AMD (Sunnyvale, CA) has been forced to delay the introduction of its first 486-compatible microprocessor until June. AMD is developing a version of the Am486 that does not use Intel microcode.

The company suffered the setback in December when a federal judge ruled that a 1976 agreement between the two companies does not allow AMD to use Intel's microcode in its latest chips. The judge's decision dealt a major blow to AMD, which had anticipated a favorable ruling and was planning to introduce the Am486 in January. In fact, AMD was already producing and stockpiling small numbers of the chip, said AMD spokesman David Frink. Those chips will probably be scrapped, unless AMD wins a timely appeal.

Because the "clean room" microcode isn't finished and will require more rigorous compatibility testing, AMD was forced to postpone the introduction.

—Tom Halfhill

Virus Protection from Within

Start-up Rosenthal Engineering ((310) 207-9948) has developed a new technology that it hopes will render current hardware and software antivirus approaches obsolete by protecting executable files from within the files' code. The company plans to market the technology to corporate clients who want to fortify their custom applications and to commercial software developers.

Rosenthal says Virus Armor is deliberately attached to a DOS or Windows application's code to "harden" it against virus attack. When Virus Armor is integrated into program code, it compresses and encrypts the files of a licensee's application. A licensee can harden all the application's files, for maximum protection, or selected files only. The technology will not be marketed directly to end users.

If you run a program hardened with Virus Armor, Virus Armor quickly scans itself, its host application, system memory and boot sector, and accessible floppy disks. If that scan finds a virus, you can scan the entire system to locate the virus and reinstall the infected program from clean master disks. Virus Armor's compression algorithm reduces the size of a hardened application. When Virus Armor detects an attempt to modify its code, it immediately reboots the system.

Virus Armor will eventually support Windows NT, OS/2, and the Mac. One caveat is that Virus Armor is applications-specific software: It only works when you load a hardened application.

—Ed Perratore

SunSelect Intrigues with WABI for Unix

Want to see your unmodified Windows 3.1 shrink-wrapped applications swish around with blazing speed on an X Window System–based Unix box? At Fall Comdex, SunSelect intrigued show goers with its demonstration of Windows applications running fast on a Sun Sparcstation. Such a technology, when released as a product, could mesh nicely with Sun's new high-powered, low-cost color Sparcclassic.

"Basically what we've done is, we've remapped the Windows API to the X Window System," said Tripp Blair, group marketing executive for emulation technologies at SunSelect (Billerica, MA). Blair said SunSelect refers to the technology internally as WABI (Windows Application Binary Interface). Unlike SunPC, SunSelect's program based on Insignia Solutions' emulation technology, WABI does not let you run DOS programs.

"Because Windows applications have to be written to an API, that API starts to separate the software from the hardware," Blair explained. "By implementing a new [WABI] layer, we can take advantage of the underlying hardware on the workstation space and provide very quick performance. We're going to eliminate the performance issue with respect to emulation," he added. When run on a non-Intel platform, however, WABI will still need to occasionally enter DOS emulation mode. Blair estimates that on a RISC platform, WABI is in DOS emulation mode about 15 percent to 40 percent of the time.

According to Blair, the plans are to implement WABI on multiple RISC platforms, as well as the Intel 80x86 platforms. SunSelect isn't saying when WABI will ship as a product.

—Dave Andrews

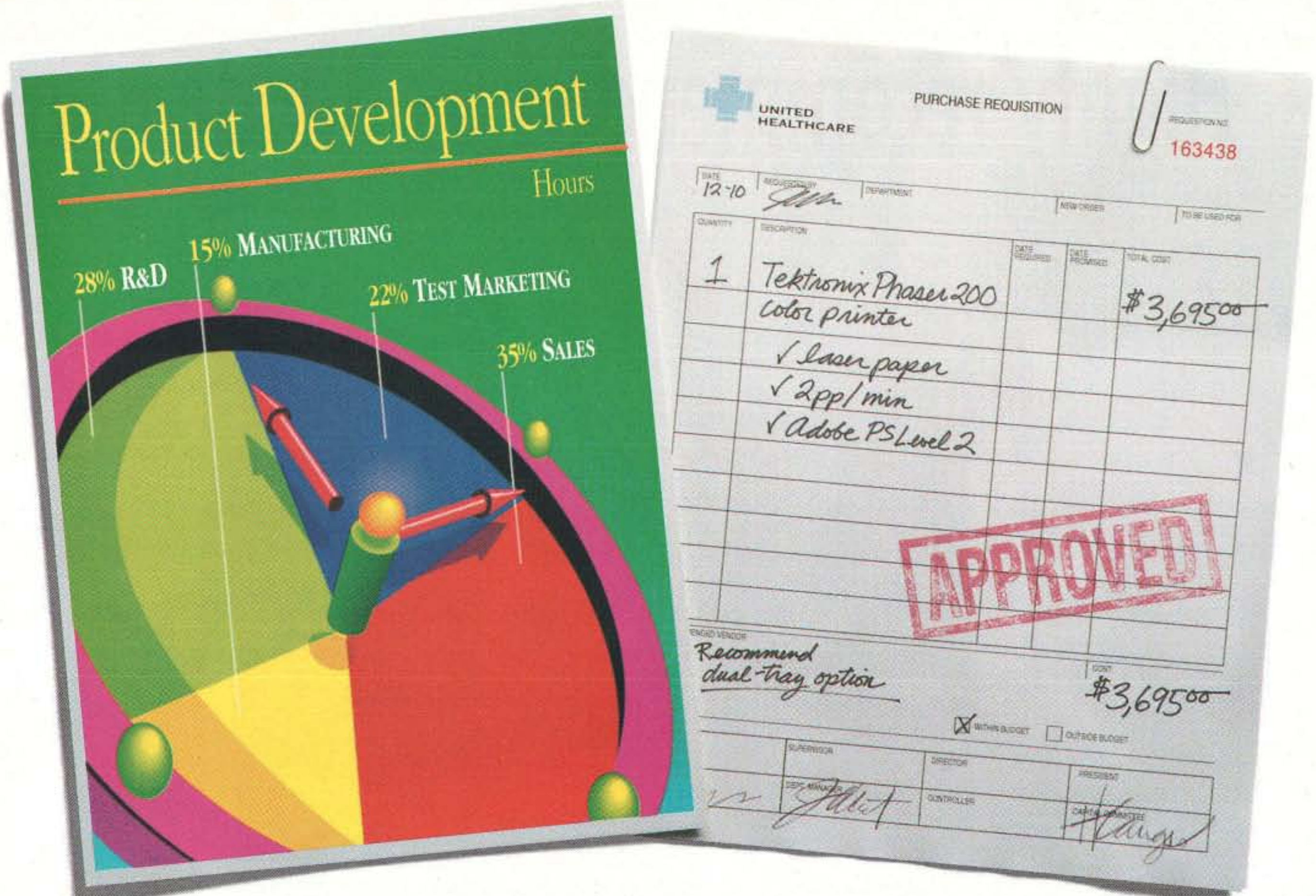
NANOBYTES

John Soyring, director of software development programs at IBM, said the company is processing about "75 new applications" a week for 32-bit OS/2 2.0 certification. IBM is now beta testing a C++ compiler for OS/2 2.0, and companies such as Borland International, Computer Associates, and Symantec should by now be shipping or close to shipping C++ compilers for OS/2 2.0. ☐

Borland, IBM, Novell, and WordPerfect have announced a database initiative to let users of Xbase, Paradox, and other database programs access data stored on a variety of software and hardware platforms without having to exit their current application. The **IDAPI** (Integrated Database API) initiative reportedly lets developers create programs that access data that's stored in a wide variety of formats. IDAPI is intended to extend the SQL Access Group and X/Open Call Level Interface. Initial support will come in the form of SDKs (Software Development Kits) from Novell, IBM, and Borland. Computer Associates and Watcom have also pledged to support the standard in their applications development products. ☐

A joint development agreement between Apple and **Micro Focus** (Palo Alto, CA) will bring the latter company's COBOL development tools to the Mac OS. ☐

Borland has gone out shopping again. Still digesting Ashton-Tate, Borland has acquired the rights to Orinda, California–based Wordtech's **Arago** line of database management software, including the beta version of Wordtech's Windows database product. ☐



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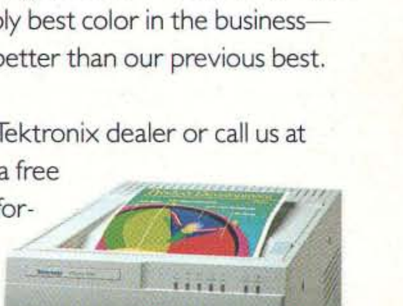

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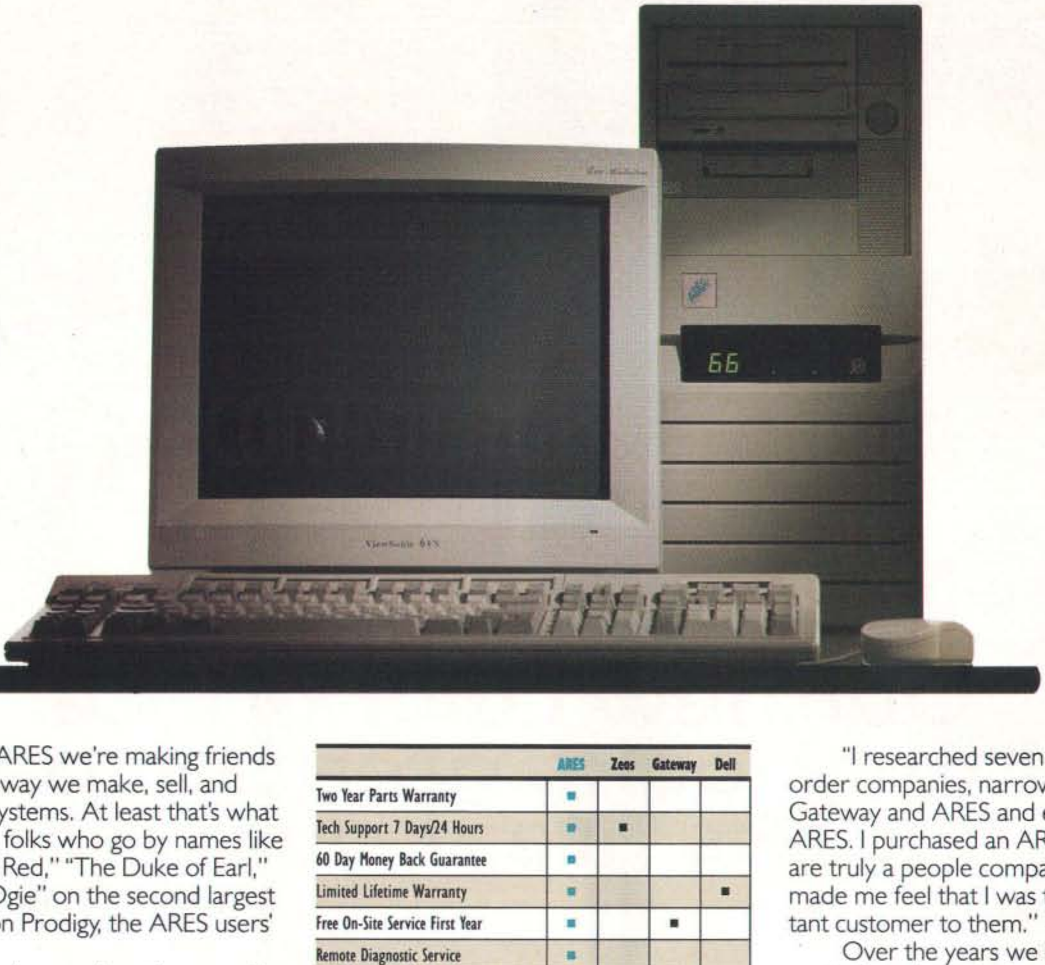

Here at ARES we're making friends for life by the way we make, sell, and support our systems. At least that's what we hear from folks who go by names like "Rhode Island Red," "The Duke of Earl," and "Dr. DOOgie" on the second largest users' group on Prodigy, the ARES users' group.

". . . when I opened up the case of my ARES, I knew this was a breed apart. The care given to detail, with all cables braided and tied down where they couldn't snag, the dab of paint on the screw heads so they wouldn't loosen by accident, and the daub of sealant on all the connections to hold them secure, all told me that this machine was no assembly line clone. It is quite obvious that ARES builds computers like a precision machine, not just as a piece of merchandise." — *Ron Liechty*

"My ARES is the fourth or fifth computer that I've owned so I can speak from experience. I've owned Apples, IBMs and a CompuAdd . . . the biggest difference about ARES . . . they seem to care more about their users after the purchase than any other company I've dealt with." — *Bonnie Williams*

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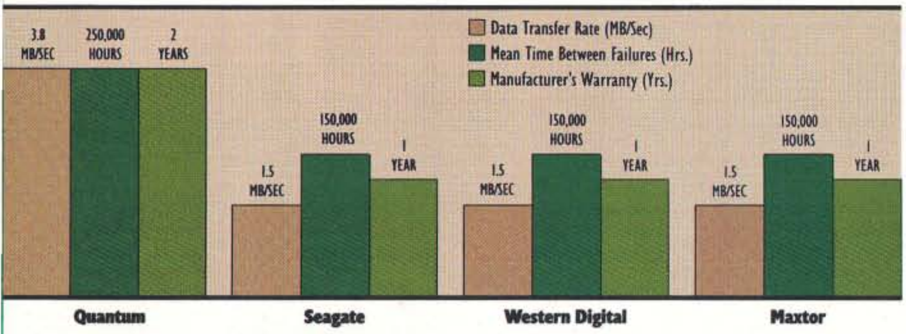
"I researched seven different mail order companies, narrowed it down tc Gateway and ARES and ended up with ARES. I purchased an ARES because th are truly a people company . . . and the made me feel that I was the most impo tant customer to them." — *Carol Gree*

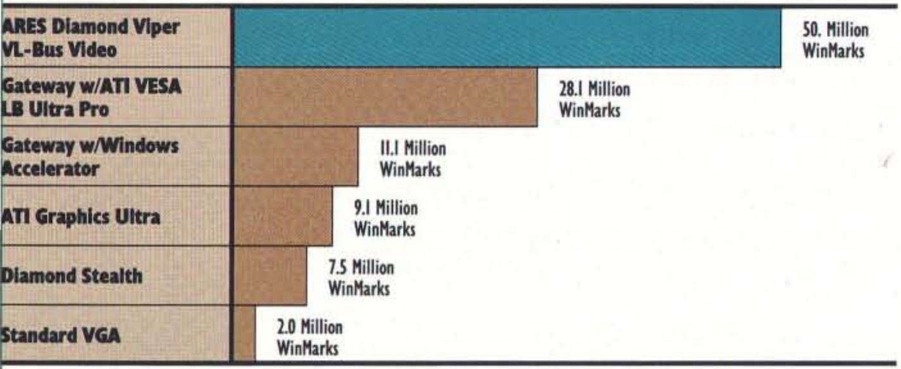
Over the years we have become meticulous about finding the best components to put into every one of our ARES machines. Quantum hard drives. Teac floppy drives. Diamond VL-Bus video cards. And the most powerful, most adaptable motherboard currently available, the new ARES VL-Bus motherboard.

With this ARES VESA (Video Electronics Standard Association) local bus, you can take advantage of these feature such as 2.88MB floppy support, fully upgradeable motherboard, two VESA 32 Local Bus/ISA slots that support industr standard 32Bit Local Bus cards for videc HD, Ethernet, etc. which will perform u to 10 times faster then EISA, supports on-board RAM of 64MB, a re-programmable FLASH BIOS that protects your investment by allowing future BIOS changes to be installed via floppy disk,

Special order items covered by manufacturer's warranty and return policies. All shipping, handling, and software charges non-refundable. Prices subject to change without notice. Sixty-day return policy begins on date of shipping. All returns must have valid ARES RMA #. All brands and product names are trademarks or registered trademarks of their respective companies.

Red, The Duke of Earl, and Dr. DOOgie.





unbreakable metal SIMM sockets that ncrease board's life expectancy, and two built-in 32Bit Local Bus IDE adapters which support four IDE devices and double the output. Which is how PC Magazine's Small Records Test shows a 240MB Quantum Hard Drive operated at 2.189 MB/sec. on a standard motherboard while our local bus IDE reached an astounding 5.01 MB/sec.

For the best on-screen performance ARES uses the Diamond Viper VLB (32 bit VESA Local Bus video card) which scores 50 million WinMark (Windows Benchmark) and displays 16 million colors.

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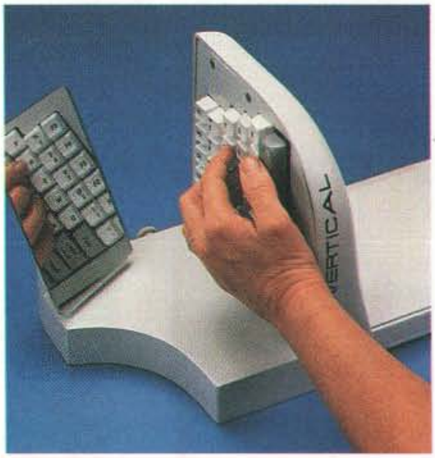
Thumbs Up to New Keyboard Designs

When you face your palms down to use a conventional keyboard, the twisting action, or *pronation*, puts a lot of stress on your hands, wrists, and forearms. This unnatural position has prompted complaints of RPI (repetitive-motion injuries) and other problems, such as Carpal Tunnel Syndrome. The Bureau of Labor Statistics estimates the cost for a single RPI incident as between $30,000 and $80,000, when you add up all the Workers' Compensation and other charges. To solve this problem, major companies (e.g., Apple) as well as start-up companies are designing new ergonomic keyboards.



The Vertical keyboard lets you keep your arm in its most natural position.

Jeff Spencer ((619) 454-0000) and Steve Albert ((619) 450-2995) have designed a new type of keyboard that they hope to license to major keyboard manufacturers. They contend that RPI injuries could be eliminated if The Vertical keyboard system (see the photo) were widely adopted.

Apple has also recognized the strains being placed on workers in the information age. You can use Apple's new Adjustable Keyboard as you would a normal keyboard; however, the Adjustable Keyboard splits into two sections that rotate up to 30 degrees apart. This lets you align your wrists to a more neutral position while typing.

—Gene Smarte and Tom Thompson

OLE 2.0: The Road to Cairo?

Microsoft has released beta versions of the OLE 2.0 specification, which Dave Seres, group program manager at Microsoft's interoperability group, said offers developers a path to Cairo, the unreleased object-oriented version of Windows. OLE 2.0 should be released in a Windows 16-bit version in March and a Mac version this summer. Seres said OLE 2.0 offers a framework for object-oriented applications development where applications drive each other. OLE 2.0 will act as a common multiplatform macro language by working across Apple's System 7.0, Windows NT, and 16-bit Windows.

One benefit of OLE 2.0 is in-place object editing. Another feature is link tracking: OLE 2.0 will let you move a subscriber of an object around without its losing its link to the provider.

Features demonstrated in OLE 2.0 have also been shown in a technology called TOOLS (Technology for Object-Oriented Linking and Sharing) from Lotus Development. John Landry, chief technical officer of Lotus, told BYTE that if OLE 2.0 offers features supported in TOOLS, Lotus will support what Microsoft does at the operating-system level.

—Dave Andrews

Apple Stakes Out Color Imaging Market

At the January MacWorld Expo in San Francisco, Apple was expected to announce its first serious entries into the color imaging market. The QuickDraw-based Apple Color Printer, tentatively priced at $2599, is a 360-dpi color ink-jet printer that supports page sizes of up to 11 by 17 inches (European A3 tabloid) at 65 screen lines per inch. Although it doesn't have a LocalTalk port, the printer is easily shared by multiple Macs: A new printer extension called GrayShare lets other computers on a network direct their output to the printer, which plugs into the SCSI port of any Mac. GrayShare also handles color and gray-scale imaging.

The company also planned to announce the Apple Color OneScanner, a single-pass, color flatbed device that supports 24-bit color (16.7 million hues) at resolutions of from 75 to 600 dpi. It comes with Ofoto 2.0, a new color version of the one-button scanning software. ■

—Tom Thompson and Tom Halfhill

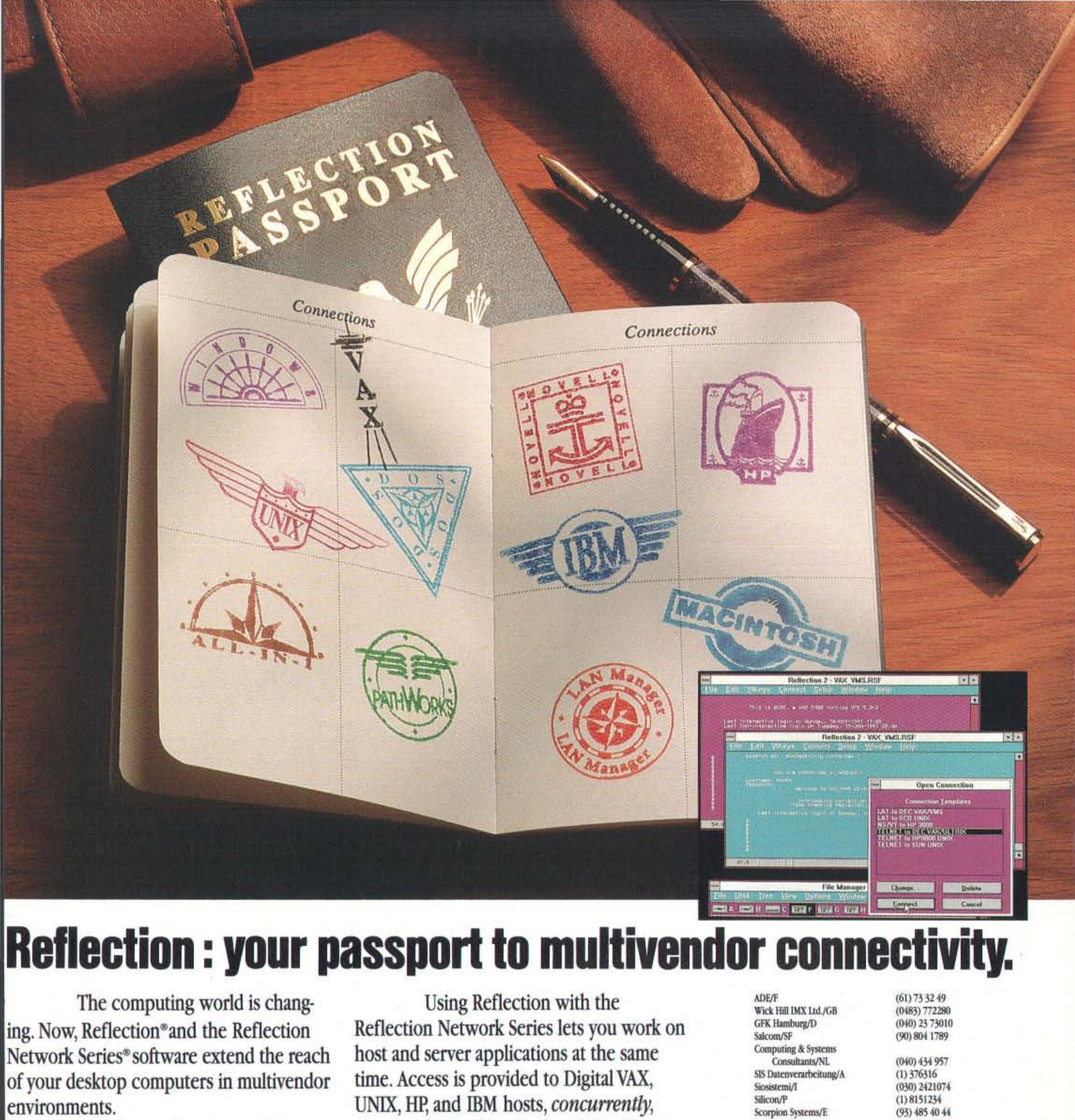
NANOBYTES

WordPerfect says that in January it will release WordPerfect Works Mac 1.2, a $249 program that is basically the BeagleWorks integrated-software program that WordPerfect bought from San Diego–based Beagle Brothers. After WordPerfect releases version 1.2 of the program, it will concentrate on making the Mac version compatible with WordPerfect Works for DOS and versions of the integrated program for unannounced "other" platforms. ☐

Cyrix has begun an upgrade program for corporations looking to upgrade their 16- and 20-MHz 386DX PCs to 33- and 40-MHz 486-instruction-set-compatible CPUs. Cyrix will sell the $399 Cx486DRu2 to customers who order at least 500 units. **Xerox** will provide businesswide Cx486DRu2 upgrades through Xerox's Customer Service Organization ((800) 451-4930, ext. 3837). ☐

The latest word on Solaris for the Intel platform is that **SunSoft** expects to ship the software early in the first quarter of this year. SunSoft has already released preliminary versions of the operating system to selected testers. ☐

Future Domain (Irvine, CA, (714) 253-0400) is now beta testing **SCSIWorks**, a universal applications interface for DOS and Windows that promises to end the problems of disparate SCSI software interfaces. The product reportedly allows applications drivers written to interfaces such as ASPI (advanced SCSI programming interface), CD-ROM, INT 13 in DOS, and others to work with Future Domain host adapters. As part of an agreement with Corel (Ottawa, Ontario, Canada), the ASPI-to-CAM portion of the program will be included in three SCSI host adapter kits from Future Domain, along with Corel-SCSI, the SCSI integration software that lets you integrate seven peripherals off a single adapter. ■



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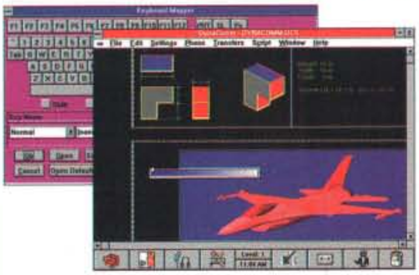

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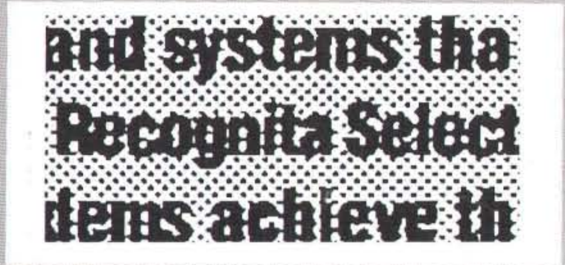
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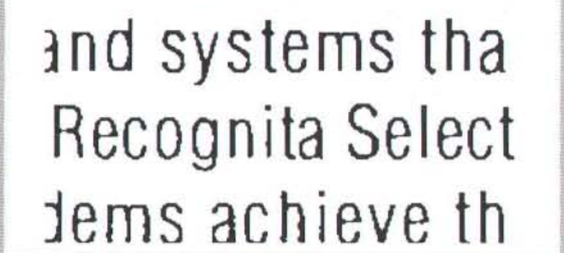
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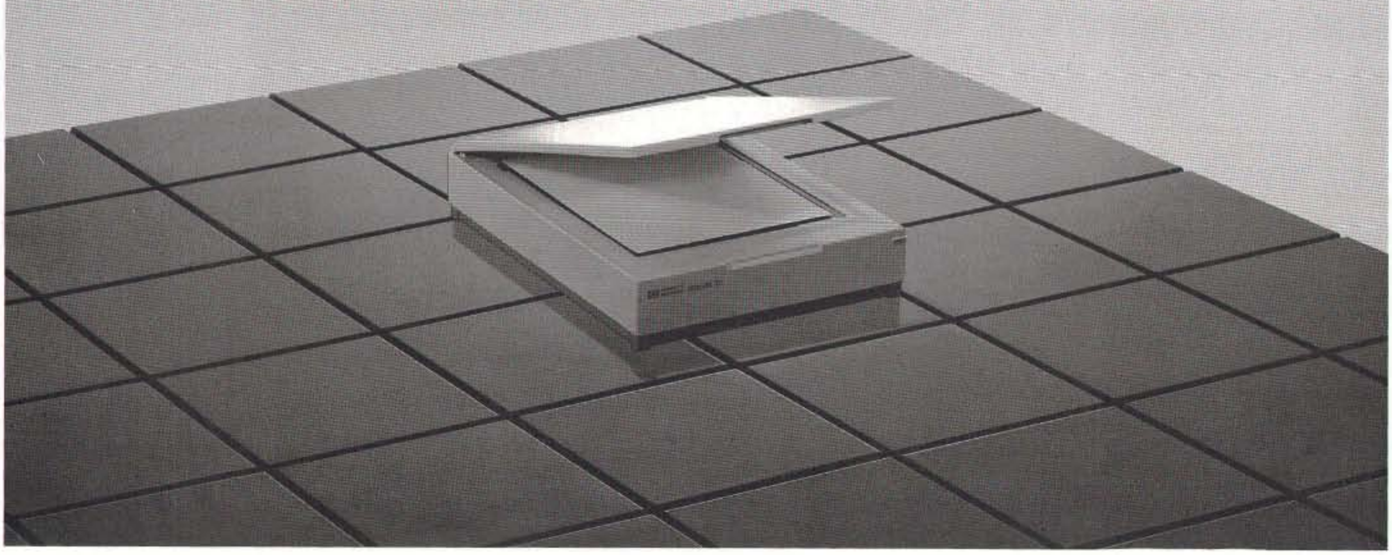

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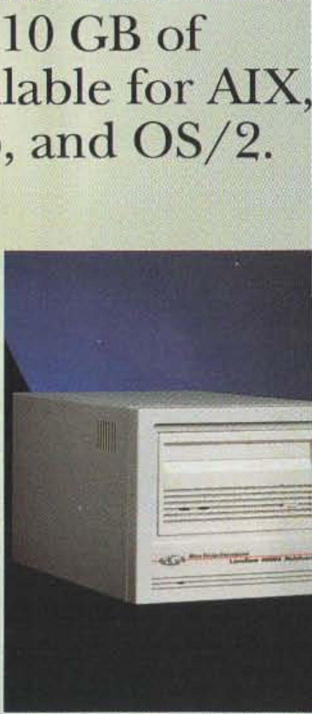

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COMDEX: BIGGER THAN EVER

The Fall Comdex show last November was a combination of good news and bad news. The bad news was the logistical nightmare that occurred when a record crowd of 140,000 converged on Las Vegas. If you were at the show, you had to spend a good deal of time waiting: waiting for a taxi, waiting for a bus, waiting for a room in a hotel.

But the good news far outweighed the bad. Comdex presented us with a record number of interesting new products. For four years now, we have been helping show attendees by highlighting the most interesting products on display—the Best of Comdex. This year, despite the efforts of 16 editors, the assortment of interesting new products made our job the hardest it has ever been.

Energy Efficiency

The first category is Best System. This category seems to be dying off of late, being supplanted by Best Portable. But this year we saw a number of impressive new systems.

The winner of the Best System Award is a bold new prototype shown by IBM. The system did not even have a real name yet, being called a "Low-End Energy-Efficient Desktop Prototype," but it is sure to have a huge impact on the industry. It consists of a small system unit (about the size of—dare I say—an IBM PCjr), a keyboard, and a 10⅖-inch active-matrix LCD color monitor. The system unit uses a 3.6-volt IBM version of the 486SX chip. It has four PCMCIA slots and consumes a total of only 30 watts. This low power consumption means it doesn't need a fan and can even be placed inside a desk drawer. Still just a "technology demonstration," this new system may appear as a product in the first half of this year.

The other finalists in the Best System category are both workstations. The DEC Alpha AXP, another prototype due early this year, is the first implementation of a personal computer based on DEC's Alpha chip, a very-high-performance RISC microprocessor.

The other finalist, the Sun Sparcclassic, sports a price tag of $4295 ($3995 in quantities of 12 or more), making it the lowest-priced color workstation on the market. It is the first system to use the new low-cost microSPARC chip developed by Texas Instruments and Sun.

The Best Gets Better

In the category of Best Portable, it seems the best just got better. Last year, an Apple Mac PowerBook was deemed the Best Portable. This year, the winner is the new Mac PowerBook Duo systems, which comprise a lightweight notebook, a docking station, and Apple's PowerLatch cableless docking technology (see "New Macs for the Desktop and Road," December 1992 BYTE). On the road, the Duo is a 4⅕-pound notebook. On the desktop, the Duo fits into a well-designed docking station that provides access to large displays, networks, expansion slots, and other peripherals.

The surprisingly large array of interesting new products at Comdex made it harder than ever to select the best

The other finalists in the Best Portable category are both penpads. The first is the EO Personal Communicator, a $2000 lightweight penpad system that offers sophisticated communications options, including a cellular-phone attachment.

And you can't mention penpads without somehow bringing up Grid—in this case, the Grid Convertible (see "Is It a Penbook or a Notebook?," December 1992 BYTE, page 60). In this penpad, the pen-input screen folds down over a standard keyboard, so you can use either input device as appropriate.

Fax by Remote

The Best Peripheral category was dominated by a newcomer, Macronix (San Jose, CA, (408) 453-8088). Its product is the Vomax 2000, an advanced messaging system for the home or office. This device features all the capabilities of a digital answering machine and data/fax modem, yet it uses only a single phone line. The Vomax's remote retrieval feature lets you access both voice and fax messages from remote locations. If you need to be notified immediately, the Vomax can automatically transfer voice and fax messages or alert you via a pager.

Of course, you can't think of peripherals without thinking of monitors. We picked the Nanao Flexscan 15-inch monitor as a finalist in the Best Peripheral category. This

ILLUSTRATION: THE INTERFACE GROUP © 1993

$899 monitor features a unique automatic power standby mode that qualifies it for the U.S. EPA Energy Star Program (see "A Window to Windows," January BYTE, page 62).

The other finalist is National Semiconductor, with its TyIN 2000 fax card. The company's first consumer product combines business audio, data, fax, and voice-mail capabilities with an expandable DSP (digital signal processor), all in a single $279 card (see "A National Voice for the PC," page 67).

Best Printer

There was such a strong selection of printers at the show that we started a new category for them. But that caused another problem: We could not select the single best printer. Thus, we picked two of them: the Hewlett-Packard LaserJet 4 and the IBM Color Jetprinter.

The LaserJet 4 and 4M printers (see "A New LaserJet, a New Standard," December 1992 BYTE) are sure to reinforce HP's leadership position in the laser-printer market. They feature a RISC processor and a 600-dot-per-inch resolution, yet they're aggressively priced at $2199 and $2999.

The $3495 IBM (Lexmark) Color Jetprinter PS 4079 uses a four-color ink-jet process to produce vibrant colors on coated paper, envelopes, transparencies, and plain paper at sizes of up to 11 by 17 inches. With its simultaneous hot ports and automatic emulation switching, it can fit smoothly into mixed environments.

The remaining finalist in the Best Printer category is the Kyocera Ecosys aSi FS-3500A. This new version of Kyocera's award-winning Ecosys printer uses the same incredibly durable amorphous silicon drum, but it's almost twice as fast, at 18 pages per minute.

Best Software

Despite a surprisingly strong array of new software at the show, selecting the Best Software winner was relatively easy. Microsoft Access (see "Microsoft's Windows Database," December 1992 BYTE) combines the user interface of Visual Basic with a new programming language called Access Basic, making it easy to create powerful database systems. As if that weren't enough, Microsoft gave the product an incredibly low introductory price of $99.

The other finalists in this category are Adobe Photoshop for Windows 2.5 and the interesting Visio from a new company called Shapeware. Photoshop, the preeminent Mac software package, has finally been moved over to Windows and comes complete with all the features of the recently released Mac version.

Visio is a Windows graphics program with a twist; but more about that later.

Best Multimedia Product

The toughest time we had was in the Best Multimedia Product category. Two products stood head and shoulders above the rest, but they had such similar strengths that it was impossible to choose between them. So we ended up naming both Apple QuickTime and Microsoft Video for Windows as winners.

On the Mac, QuickTime is already the standard for viewing digital video, animation, sound, and other dynamic information on your computer screen. With QuickTime 1.5, Apple has added support for Kodak's PhotoCD format, closed-captioned text, and higher-performance software-only playback. Apple has also released QuickTime for Windows, which lets you play Mac QuickTime movies under Microsoft Windows.

Meanwhile, Microsoft Video for Windows (see "Microsoft's Small-Screen Debut," December 1992 BYTE, page 56) is neither the first nor the only software technology for managing digital video, but it is sure to set the standard for digital video in the fast-growing Windows market. Dozens of developers are already racing to support it, which should result in a new generation of multimedia applications.

The remaining finalist in the multimedia category is Brown-Wagh, with its StudioMagic board. This $495 PC board lets anyone do video editing on a PC.

Best Connectivity Product

Microsoft dominated another category, this time with its Windows for Workgroups (see "Windows for Workgroups," November 1992 BYTE). This product combines peer-to-peer networking functionality with exceptional ease of use. The program features network DDE, which lets applications exchange information across a network.

The other finalists in this category are WordPerfect Office 4.0 and a Xircom PCMCIA Ethernet card. The new version of WordPerfect Office will combine E-mail with group scheduling and calendaring for DOS, Windows, and Mac platforms. And the $395 Xircom Credit Card Ethernet Adapter was the most significant and most practical of the many implementations of PCMCIA cards at the show.

Most Significant Technology

In a broad sense, three technologies at Comdex seemed to be almost omnipresent: the PCMCIA cards, local bus, and wireless communications. But several brand-new technologies were on the show floor. Our choice as the Most Significant Technology is Adobe's Acrobat. Acrobat lets you create documents on one type of system and send them to any other, where they can be read or printed with little loss in detail or resolution. Acrobat's foundation is its portable document format, a device-independent file format that can be read on many different types of systems.

The other two finalists in this category are Intel's Indeo and IBM's voice-recognition technology. Indeo is a software product that lets you play video on systems that lack special video hardware. Video quality is automatically adjusted depending on the available hardware. The Indeo technology will be incorporated into Apple QuickTime, Microsoft Video for Windows, and IBM OS/2 environments.

IBM showed three voice-recognition technologies at the show, but its speaker-independent continuous-speech-recognition technology was the best. Developed with Carnegie Mellon University, it lets an IBM RISC System/6000 or a 486DX-based PS/2 recognize speaker-independent continuous speech. The system has a vocabulary of 1000 words at a time, but new vocabularies can be substituted almost instantaneously. A beta version of a developer's kit for this technology is available for a price of $3995.

Best Rookie

The best newcomer to Comdex was Shapeware (Seattle, WA, (206) 467-6723), a company founded by former Aldus executives. The Visio software for Windows is a graphics package with a difference. It lets "graphically challenged" businesspeople easily create flowcharts, schematics, and other diagrams using predesigned stencils or templates. (See "Shapeware's Visio Draws a New Path," January BYTE, page 64.)

Best of Show

And finally, we had to choose the Best of the Best, our Best of Show Award. This honor was won easily by Adobe's Acrobat technology. We see this technology as having a far-reaching impact on the world of personal computing. If Acrobat delivers what Adobe says it will, it should touch the lives of every PC user. By helping to cut the wasteful use of paper, it should also help preserve resources, thereby touching the lives of everyone on the planet. ■

Rich Malloy is BYTE's executive editor based in New York. You can reach him on BIX as "rmalloy."

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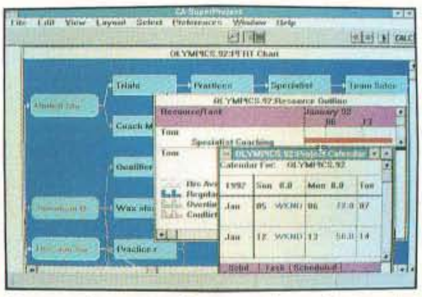

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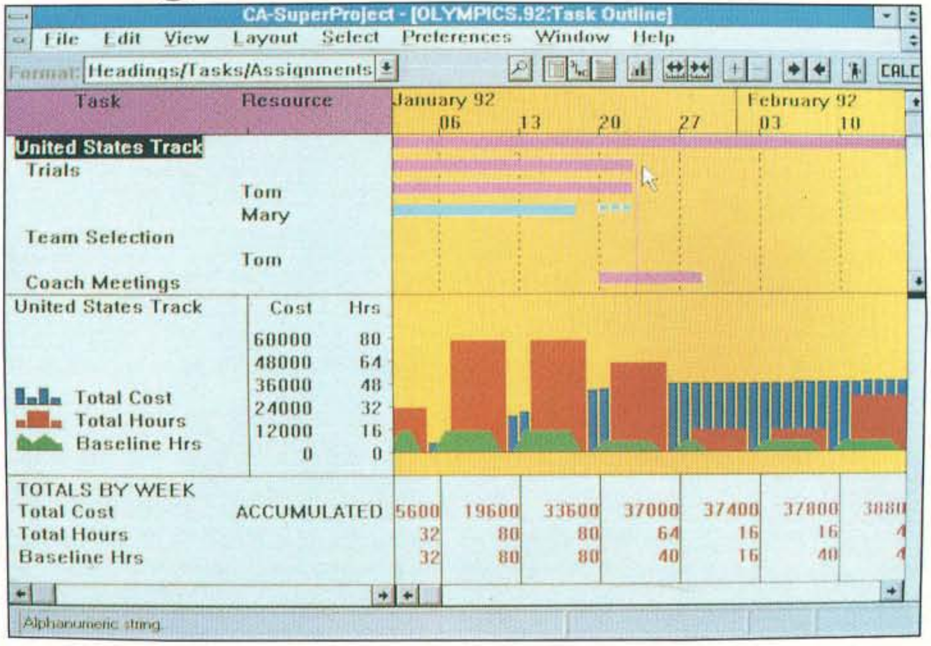

CA-SuperProject - [OLYMPICS.92:Task Outline]

File Edit View Layout Select Preferences Window Help

Format: Headings/Tasks/Assignments

Task	Resource	January 92
United States Track		
Trials		
	Tom	
	Mary	
Team Selection		
	Tom	
Coach Meetings		

United States Track	Cost	Hrs
	60000	80
	48000	64
	36000	48
Total Cost	24000	32
Total Hours	12000	16
Baseline Hrs	0	0

TOTALS BY WEEK								
Total Cost	ACCUMULATED	5600	19600	33600	37000	37400	37800	3880
Total Hours		32	80	80	64	16	16	4
Baseline Hrs		32	80	80	40	16	40	4

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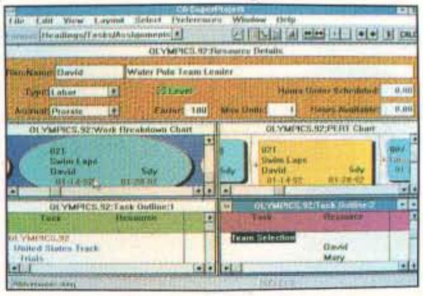
OLYMPICS.92:Resource Details
OLYMPICS.92:Work Breakdown Chart
OLYMPICS.92:PERT Chart
OLYMPICS.92:Task Outline
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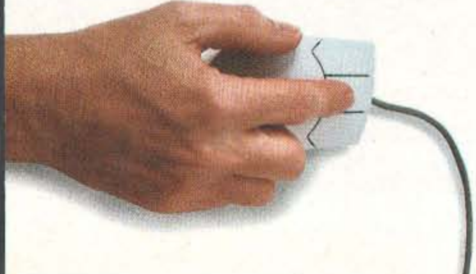

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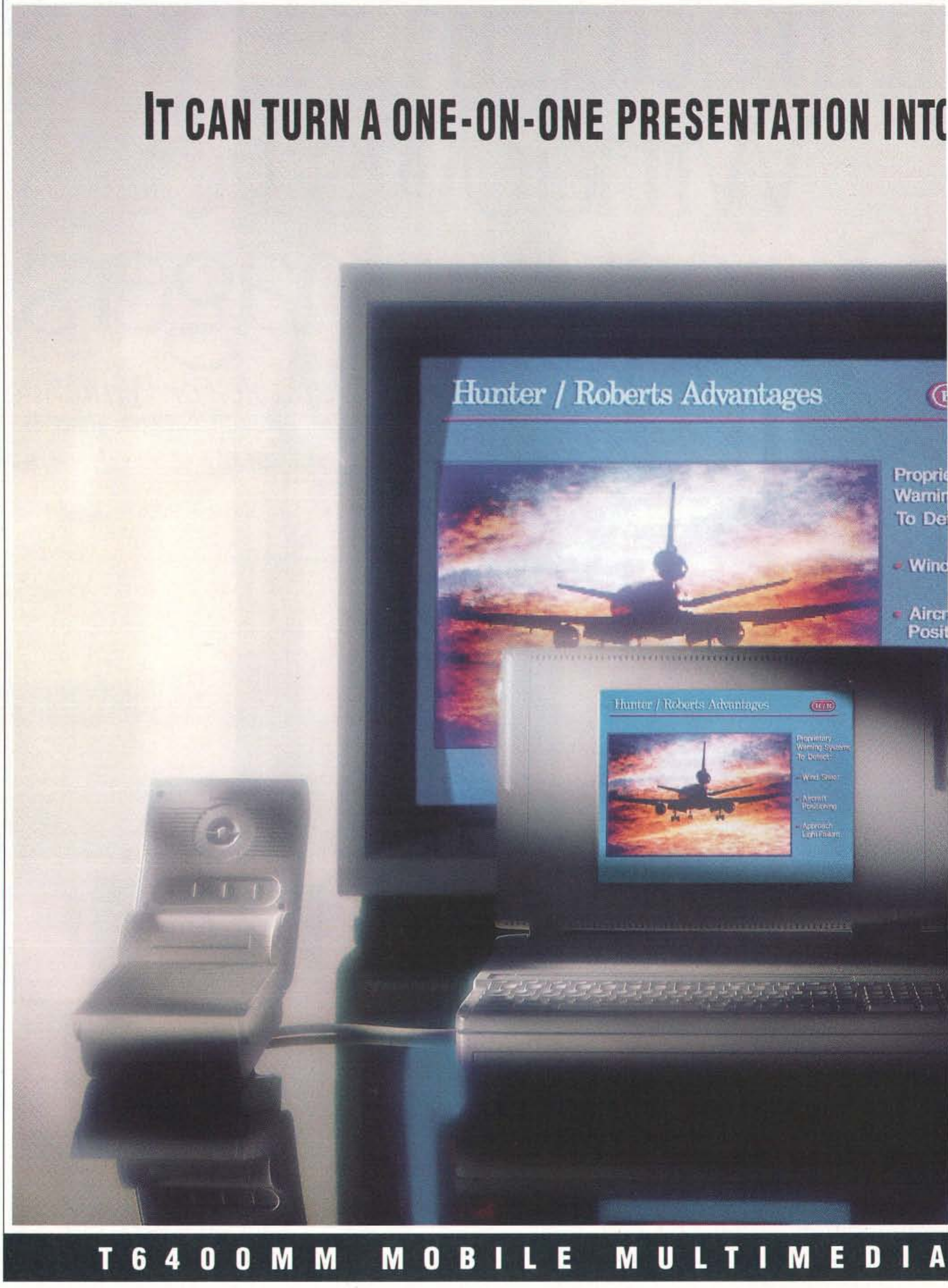
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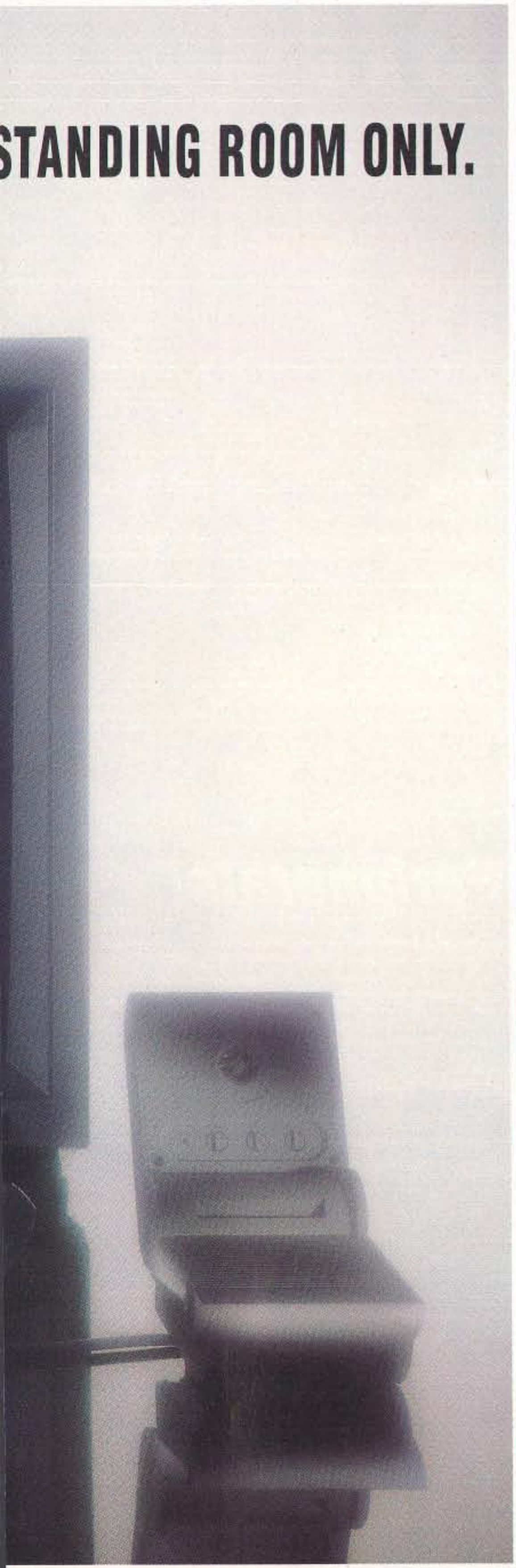

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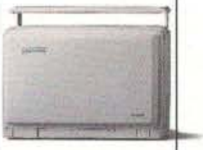

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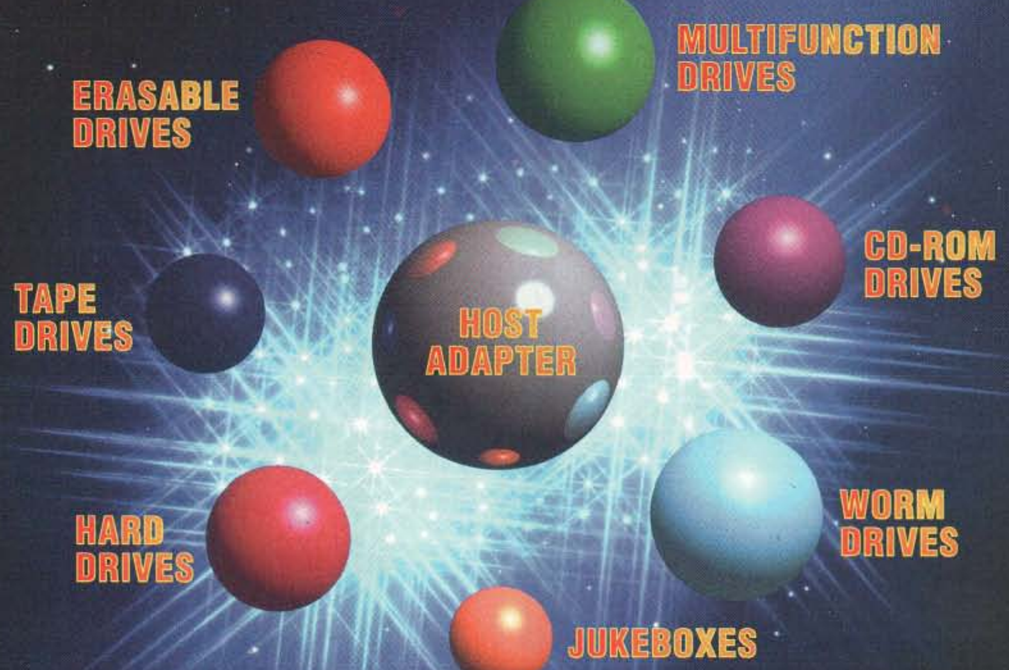

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ANDY REDFERN

COMPUTERS ITALIAN STYLE

MILAN—Few people know that one of the biggest computer shows in the world, Smau, is held in Italy. Smau was hot, crowded, noisy, and big. In terms of hall space, Smau is larger than Fall Comdex and is second only to the Hannover CeBIT show. For such a big show, it is remarkable how few of the exhibitors are Italian hardware and software manufacturers.

IBM and Olivetti account for about half the sales in the Italian PC market, with the other half split three ways. One-third goes to big U.S. vendors (e.g., AST Research, Tandon, Compaq, and Zenith). Another third consists of large European PC vendors. The final third goes to the no-name box shifters who simply rebadge technology from Taiwan and Hong Kong.

Olidata is an Italian company of some note. It began life in 1982 as an accounting software house developing products for Olivetti systems. In 1986, it broke with Olivetti when it saw an opportunity to import cheap PCs from the Far East.

Olidata, based in Cesena, sells all its machines through dealers. Adolfo Savini, Olidata's marketing manager, points to the fact that there are some 90,000 dealers in Italy (around 10 times the number in the U.K.). Every village has someone who acts as a dealer. Olidata currently sells only in Italy, but it has plans to enter the U.K. market through a joint venture.

Hantarex is one of the world's biggest monitor suppliers, making everything from terminal screens to video walls. The monitors are manufactured in Florence and Milan. The Florence factory is a fully automated, robotic production facility making in excess of 1500 monitors a day. The majority of Hantarex's monitors are sold through OEM channels. Olivetti, IBM, AT&T, and Siemens all use Hantarex monitors. Hantarex also has its own PC brand, called Vegas. It has recently attempted to cut costs by moving its nontechnical production to Hungary, where Hantarex claims the labor is cheaper than in either Hong Kong or Taiwan.

In Italy, U.S. software dominates. DOS, Windows, OS/2, and various flavors of Unix are the only operating systems you see, and all the major application areas are dominated by Lotus, Microsoft, and WordPerfect.

One ray of light is the Baveno-based Italian Software Agency. It produces a Clipper CASE tool that was intended initially just for the Italian market. Its success has led the company to announce an English version. The product is called dBsee (for database software engineering environment), and it generates Clipper code automatically through a neat user interface. The English-language version of dBsee should be available by the time you read this.

Perhaps one reason why there is little Italian software is that nobody seems to buy it. In the U.S., the average number of software licenses sold per PC (excluding the operating system) is between two and three. In Italy, for every three PCs sold, just one software package is sold. The Business Software Association estimates that if software usage is at U.S. levels, developers are losing about 700 billion lire ($700 million) in Italy.

The Italians love computers with style but crave innovative products from around the world

The BSA tries to stop piracy, but the Italian law is not strong or quick enough to make prosecution easy. According to Enzo Mazza of the BSA, the only solution is education. He has launched an "I love original software" campaign, which he believes has had some effect. Cynics however, suggest that it is a problem for all southern Europe, a problem that will be solved only if software is protected.

After a few days in Italy, you realize that what your PC looks like is more important than you'd think. Olivetti, for example, is redesigning its whole range to capture the designer market. In fact, one Olivetti director implied that he didn't care what I thought about the technical specification of its Quaderno subnotebook—the company was selling it as a *fashion accessory*, not a tool.

That said, it was with some amusement that I perused the entries in the Smau Best of Show Design Awards. Although Olivetti had a smattering of nominees, most awards went to gadgets designed outside Italy. Although Italians consider style important, they recognize the value of innovation from other countries. ■

Andy Redfern is BYTE's former U.K./Europe bureau chief. You can reach him on BIX as "aredfern."

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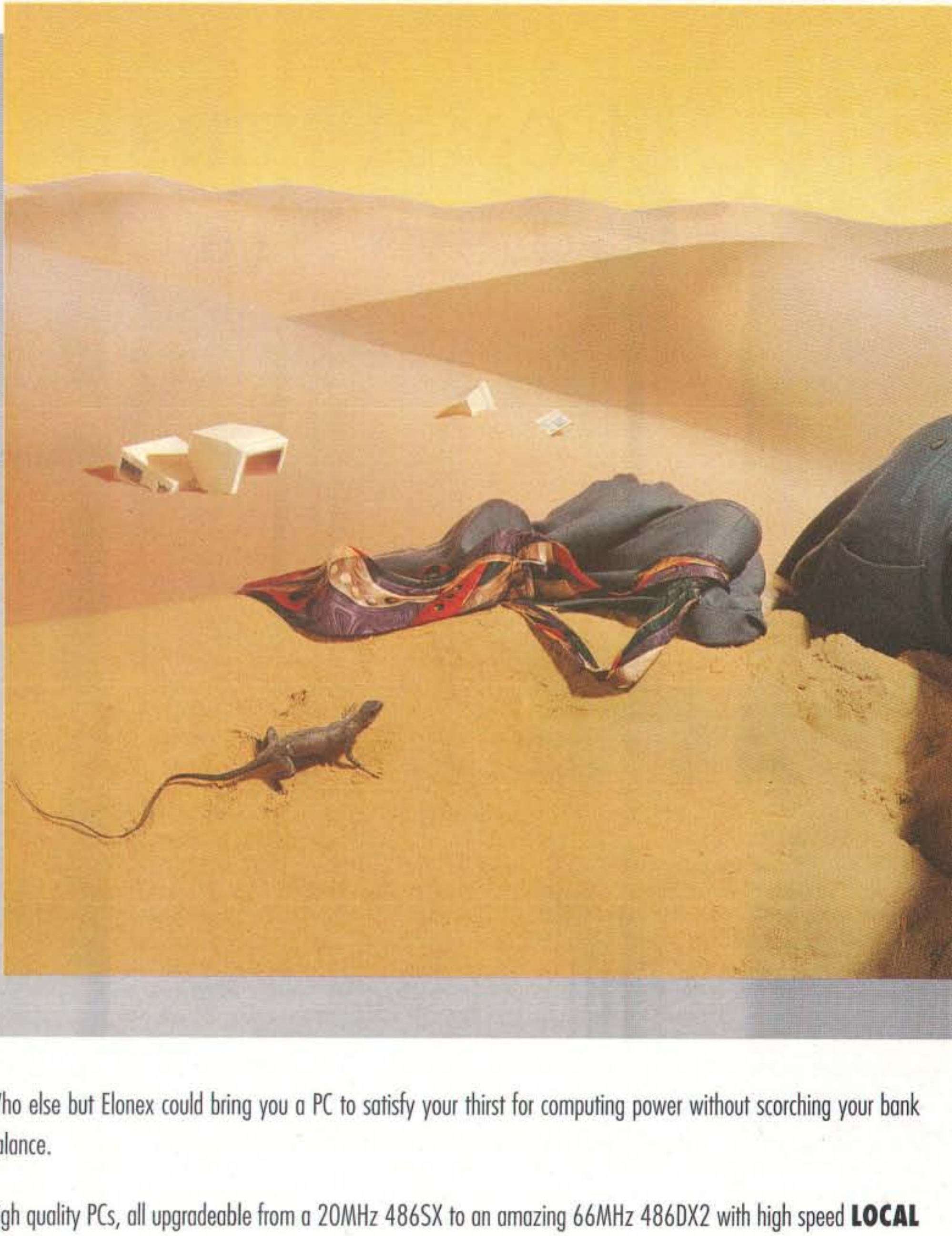

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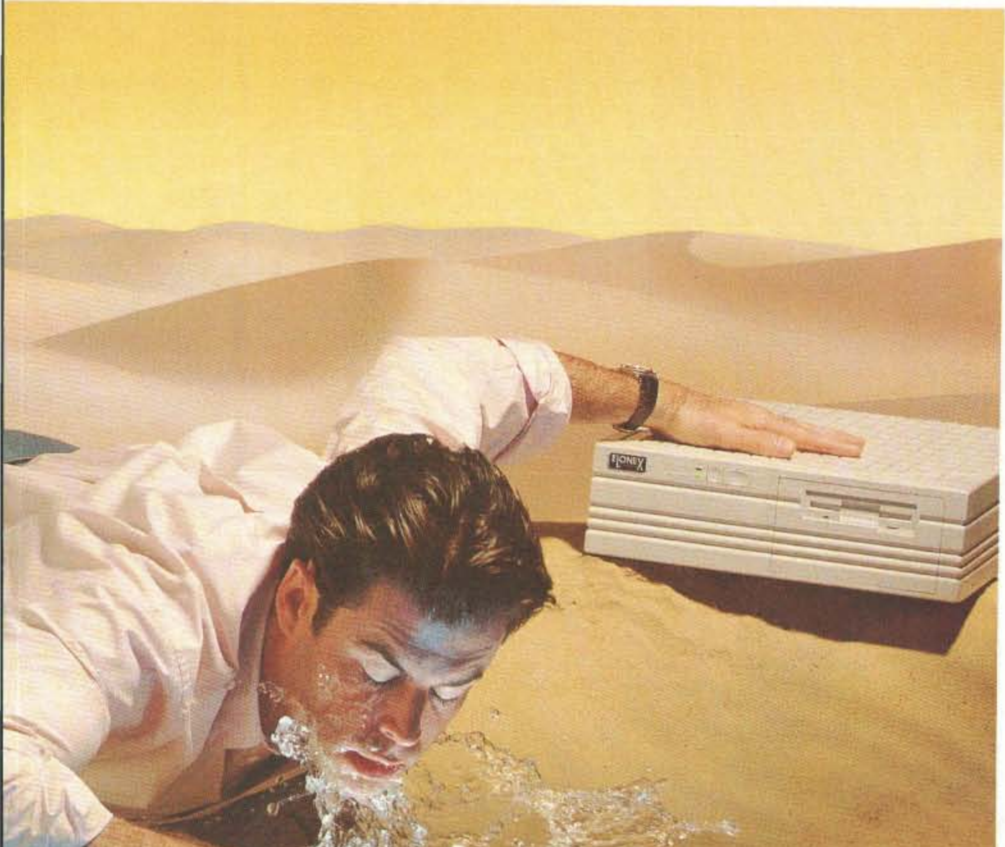

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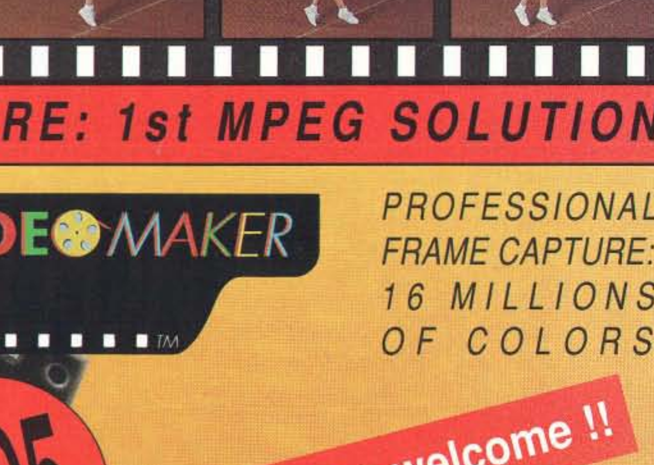

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Aspect ratio	square pixel	rectangular pixel
Size of the board	short: compatible with desktop PCs	long
Technology	miniaturized: SMT	classic
Installation	no switches at all	many switches
IRQ, DMA	none: high compatibility	several IRQ and DMA
SVGA modes	all	limited
Video feature connector	not needed	absolutely necessary
RAM limitation in your PC	unlimited	conflict above 8 MB

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Lotus Improv for Windows

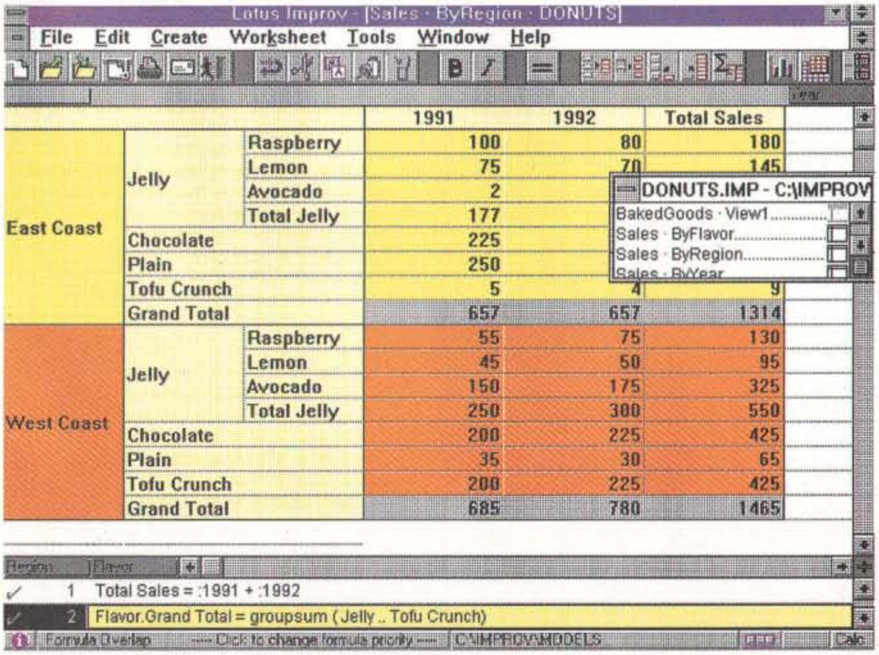
KENNETH M. SHELDON

Lotus's Improv spreadsheet builds and automatically applies formulas

Two years ago, Lotus Development introduced Improv, a radically different kind of spreadsheet (see "What's NeXT After 1-2-3?," October 1990 BYTE). The problem with Improv was that you needed a Next computer to run it—which meant that most of us couldn't. Now, Lotus has released Improv for Windows. Although it may not lure advanced users away from more traditional spreadsheets—such as Excel, 1-2-3, and Quattro Pro—the results are fascinating, and Improv is sure to influence the future development of the spreadsheet.

Itemizing Your Data

Ordinary spreadsheets organize data into rows and columns. Improv, on the other hand, looks at data as *items*. Instead of A, B, C and 1, 2, 3, Improv uses item labels, such as "Territory" and "Sales." Cells that in traditional spreadsheets would have names such as "C3" become "Eastern Region:Q1," and a typical spreadsheet range such as "A3..A15" becomes the more meaningful "Jan..Dec" in Improv.



			1991	1992	Total Sales
East Coast	Jelly	Raspberry	100	80	180
		Lemon	75	70	145
		Avocado	2		
		Total Jelly	177		
	Chocolate		225		
	Plain		250		
	Tofu Crunch		5	4	9
	Grand Total		657	657	1314
West Coast	Jelly	Raspberry	55	75	130
		Lemon	45	50	95
		Avocado	150	175	325
		Total Jelly	250	300	550
	Chocolate		200	225	425
	Plain		35	30	65
	Tofu Crunch		200	225	425
	Grand Total		685	780	1465

```
✓ 1 Total Sales = :1991 + :1992
✓ 2 Flavor.Grand Total = groupsum ( Jelly .. Tofu Crunch)
```

Screen 1: *Improv's worksheets organize your data by items, letting you create subcategories within an item.*

To create a formula with Improv, you just point and click on the appropriate items. Improv builds the formula in a *formula pane* that is attached to the bottom of the worksheet and applies it to all items that are appropriate. (Of course, if you're a masochist, you can still enter your formulas manually from the keyboard.) While other spreadsheets may let you name cells, ranges, and formulas, the procedure is not set up as an integral part of the structure, as it is with Improv, and is nowhere near as easy.

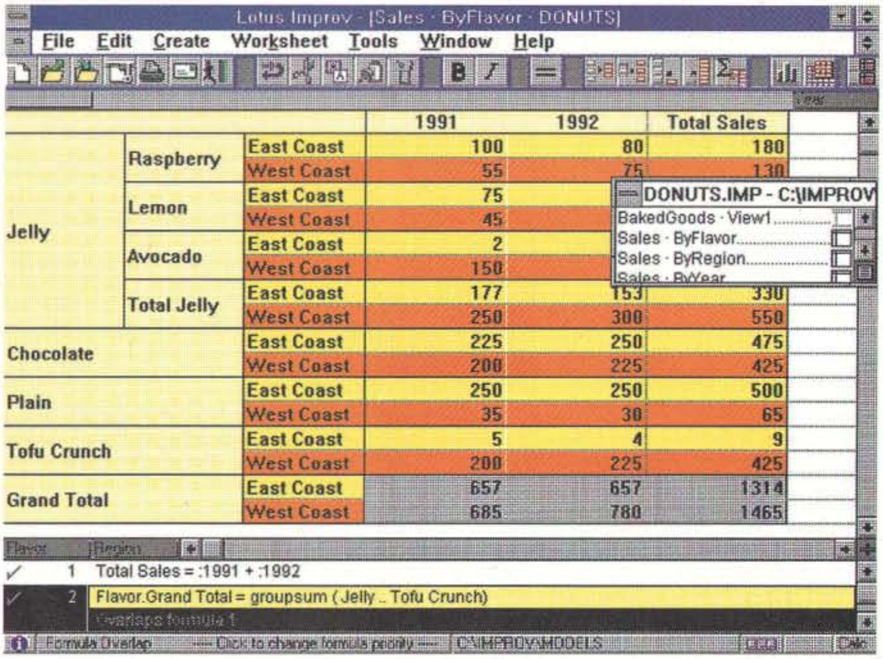
Screen 1 is a worksheet for a doughnut company, with three categories of items: Region, Year, and Flavor (a subcategory of Region). To see Region as a subcategory of Flavor (so you can tell where plain doughnuts sell best), you just drag and drop the Flavor *tile* (a button in the lower left of the window) in front of the Region tile. Improv instantly rearranges the data (see screen 2). Drag the Year tile to the upper left of the windows, and Improv places each year on a separate page, which you can flip through by clicking on the page icons. Each of these pages is a *view* of the underlying model. Improv lets you create as many as 16 different views and then choose among them using a *browser* window.

Improv formulas are smart (note that the formula for Grand Total of doughnuts sold is smart enough to ignore subtotal Jelly Total), as well as being general-purpose. To create the doughnut spreadsheet using a typical spreadsheet application would require 28 formulas, each existing in a separate cell. Improv uses just three formulas.

A Windows View

In porting Improv to Windows, Lotus adopted the overall Windows look, as well as many of the features that are becoming standard to that environment. For instance, a row of SmartIcons lets you perform common actions at a click of the mouse, and a status bar at the bottom of the window gives you information about the current selection. You can customize the SmartIcons palette, even adding your own icons to which you attach macros to automate repetitive tasks.

If you don't like the SmartIcons or status bar, you can simply hide them. And a



			1991	1992	Total Sales
Jelly	Raspberry	East Coast	100	80	180
		West Coast	55	75	130
	Lemon	East Coast	75		
		West Coast	45		
	Avocado	East Coast	2		
		West Coast	150		
	Total Jelly	East Coast	177	153	330
		West Coast	250	300	550
Chocolate		East Coast	225	250	475
		West Coast	200	225	425
Plain		East Coast	250	250	500
		West Coast	35	30	65
Tofu Crunch		East Coast	5	4	9
		West Coast	200	225	425
Grand Total		East Coast	657	657	1314
		West Coast	685	780	1465

✓ 1 Total Sales = :1991 + :1992

✓ 2 Flavor.Grand Total = groupsum (Jelly .. Tofu Crunch)

Overlaps formula 1

Formula Overlap --- Click to change formula priority --- C:\IMPROV\MODELS

Screen 2: *Improv's smart formulas let you rearrange your items simply by dragging and dropping a tile.*

click of the right mouse button on a SmartIcon brings up an explanation of that icon. (Elsewhere in Improv, clicking on the right mouse button brings up a menu of actions that are appropriate to that particular object, such as changing the color, font, or justification.)

To create a chart in Improv, you select a worksheet (or range) and click on the Create Chart icon. Improv automatically creates a bar chart (although you can easily change the program so that a different style of chart is created) and lets you add colors and titles and hide elements, as well as many other options. Improv reverses the usual worksheet-chart relationship: Rather than place a chart directly on a worksheet, you add a *hotview* (essentially a copy of the worksheet) to a chart. Any changes you make to the worksheet are immediately reflected in all charts and hotviews.

Improving Your Old Worksheets

Improv's features make it easy to create new worksheets. But what about worksheets that you've created with other applications?

Improv will import worksheets from Lotus 1-2-3 (including the new release 3.4), Excel, and a variety of other formats, and you can tell it to use the row and column labels as item names. As Improv imports a spreadsheet, it filters cells that contain formulas and converts them to Improv formulas. Also, Improv alerts you if any of the formulas didn't make the trip successfully.

Unfortunately, due to the difference in the way a traditional spreadsheet organizes data, you may have to do a fair bit of massaging to get your Improv worksheet to look right. And if you need to import a 3-D spreadsheet, things get even trickier. In my tests with a beta version of Improv, I was able to import some (but not all) of the Excel worksheets I tried, and formulas containing references to other worksheets were lost.

Improv maintains multiple spreadsheets as pages of a single worksheet or as several worksheets in a single *model*. You can link worksheets in a model by pointing and clicking to create *intersheet formulas*. To link worksheets not in the same model—or those in other applications—you must use DDE or OLE links.

Aside from the issue of importing data, Improv has just a few interface quirks, such as the lack of a button to automatically resize columns to fit cell contents. Nor can you add blank lines to a worksheet for appearance's sake. And while Improv can automatically assign label names (e.g., duplicate an item called "Jan," and Improv will automatically label the next items "Feb," "Mar," and so on), this feature doesn't work as well as Excel's auto-fill feature: Create the labels 1, 3, and 5, and Improv will label the next item 6, unless you explicitly spell out the steps in a Data Fill dialog box.

A New Species of Spreadsheet

The development of the spreadsheet is surely a case of punctuated evolution: gradual improvements marked by occasional dramatic changes. Just as VisiCalc was overwhelmed by the speed and charting abilities of Lotus 1-2-3, 1-2-3 has lately been challenged by spreadsheet programs better adapted to the world of graphical interfaces.

In spite of a few minor quirks, Improv is a major advance in the spreadsheet metaphor. It is probably the easiest spreadsheet for novices to learn, and even old hands may find the traditional spreadsheets they're used to working with to be inflexible and hidebound once they've played with Improv. Now that Improv has migrated to the Windows world, the effect on the rest of the spreadsheet community should be very interesting. ■

Kenneth M. Sheldon is a consulting editor for BYTE specializing in new computer technologies. You can reach him on BIX as "ksheldon."

THE FACTS

Improv for Windows
$495

System requirements:
A 386SX or higher with VGA, a mouse, DOS 3.31 or higher, Windows 3.1, 4 MB of RAM, and a hard disk with up to 12 MB of free space.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(800) 343-5414
(617) 577-8500
fax: (617) 693-1197
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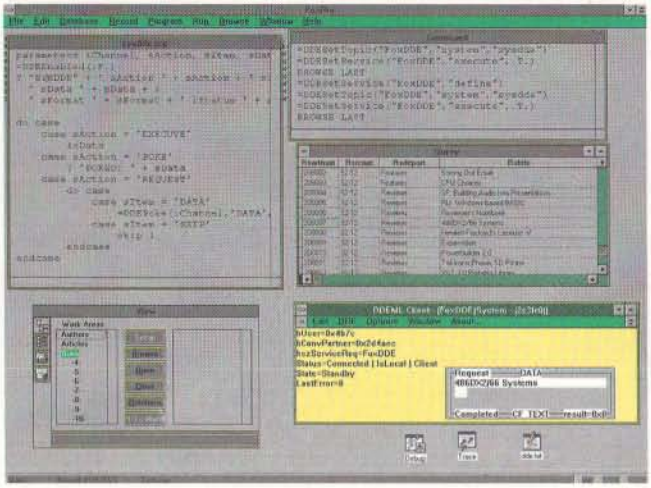
FoxPro 2.5 for DOS and Windows



```
=DDESetTopic("FoxDDE","system","sysdde")
=DDESetService("FoxDDE","execute",.T.)
BROWSE LAST
=DDESetService("FoxDDE","define")
=DDESetTopic("FoxDDE","system","sysdde")
=DDESetService("FoxDDE","execute",.T.)
BROWSE LAST
```

```
hUser=0x4b7c
hConvPartner=0x2d4aec
hszServiceReq=FoxDDE
Status=Connected | IsLocal | Client
State=Standby
LastError=0
```

Like many FoxPro users, I rejoiced in the speed and power of the blockbuster version 2.0. I worked hard to develop a multiuser FoxPro application that would enable BYTE's DOS, Windows, Mac, and Unix users to share data on our LAN. Clearly, I should have paid more respect to Murphy's Law. The challenge of merging three code bases into a common core made the vision of multiplatform FoxPro painfully slow to materialize. The simultaneous release of **FoxPro 2.5 for DOS and for Windows** represents two giant steps in the right direction. Both are high-performance multiuser products that can share not only common data, but also common FoxPro application code.

My first test of FoxPro for Windows was, of course, to rebuild and run my biggest version 2.0 application. It worked, but what appeared in the upper-left quadrant of my 1024- by 768-pixel Windows display were ugly caricatures of my carefully designed FoxPro 2.0 screens. By default, FoxPro for Windows presents DOS-defined screens using a monospace OEM font, squashed controls, and lines and boxes made from characters rather than Windows graphics.

To perform a Windows face-lift, you edit the screen's underlying database (its .SCX file) using the FoxPro for Windows screen builder. It spawns a tool called the *transporter*, which automatically duplicates each screen-definition record, tags one member of each pair for DOS and the other for Windows, and assigns default fonts, sizes, and positions to the Windows elements. When you generate code from that screen database, you're actually creating two similar programs wrapped up in a giant case statement. At run time, one of those branches will execute depending on whether the system variable _DOS or _WINDOWS is true.

While the automatic treatment yields true Windows screens, I had to fiddle a lot with color, size, style, and placement to make my screens look good. I'd rather not repeat the exercise for the Mac and then for Unix. A more intelligent transporter could simplify that chore. Even then, there would be another wrinkle. Automatic bracketing of code for multiple platforms requires use of the screen builder and code generator. I use these tools for all static interface elements, but I've tended to hand-code dynamic elements such as pop-up menus. Now I'll have to test for _DOS or _WINDOWS (or, soon, _MAC or _UNIX) in each of these cases and code variations for each platform. I'd hoped to avoid that. If DOS is my reference platform, I shouldn't need to make exceptions for Windows.

Conversion hassles aside, there's a lot to like about FoxPro for Windows. A 32-bit application built on Watcom's Windows extender, it runs single-table queries briskly and blows away version 2.0 on multitable queries. There are plenty of Windows goodies as well. The new GENERAL data type holds sounds, pictures, and other objects that are dished up by OLE servers.

FoxPro's DDE support is spiffy. I was delighted by how easily I made FoxPro play the role of a DDE server that could receive SQL queries from DDE clients, execute the queries, and poke back results. Other Windows enhancements include odometer-like "spinner" controls, functions that call the Windows common font and file dialog boxes, and the ability to drag and drop lines in the text editor. The beta version I tested wasn't able to call DLLs from FoxPro code or use ODBC (Open Database Connectivity) to fetch foreign data—two features Microsoft says will appear in the shipping product.

If it weren't for all the new toys in FoxPro for Windows, I'd be tempted to stick with its DOS counterpart. Like version 2.0, it comes in 16- and 32-bit versions. The latter, which is now built on Phar Lap's DPMI (DOS Protected Mode Interface)-compliant DOS extender, coexists with the DOS 5.0 and Windows 3.x memory managers and is also screamingly fast. I won't benchmark formally until both version 2.5 products ship, but it looks like the 32-bit DOS product will leave the 32-bit Windows product in the dust. Because it can now also run under Windows, the DOS product merits serious consideration even in Windows-centric environments. What you gain with the DOS version is speed and freedom from multiple-platform maintenance. What you lose, though, is the ability to stir the spicy FoxPro ingredient into a rich stew of Windows applications.

How does FoxPro for Windows compare to Access? It depends. If I had to target only Windows, I'd go with Access, which is smoother than FoxPro's initial Windows port. Access's intrinsic SQL is also more appealing than FoxPro's layered, read-only SQL. I'd favor FoxPro for raw speed, however, particularly with huge databases. And, of course, I still hope to deliver my FoxPro application to Mac and Unix users. FoxPro's multiplatform strategy isn't as refined as I'd like, but it looks workable. Murphy willing, I'll find out for sure later this year.

—Jon Udell

THE FACTS

FoxPro 2.5 for Windows
FoxPro 2.5 for DOS
$495 each

System requirements:
Hardware (DOS): A 286 for the 16-bit version; a 386 with 2 MB of RAM for the 32-bit version.
Hardware (Windows): A 386 with 4 to 6 MB of RAM.
Software: DOS 3.1 or higher; Windows 3.0 or higher.

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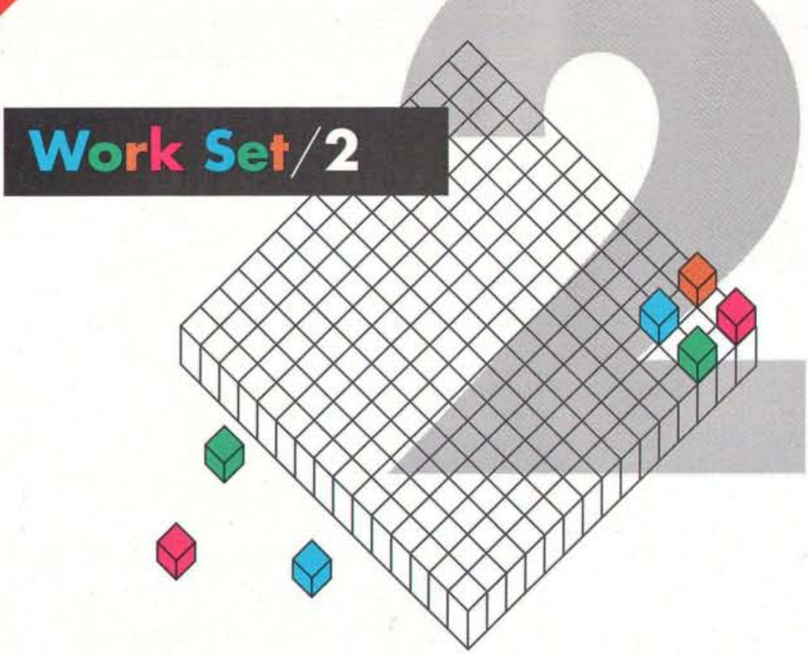

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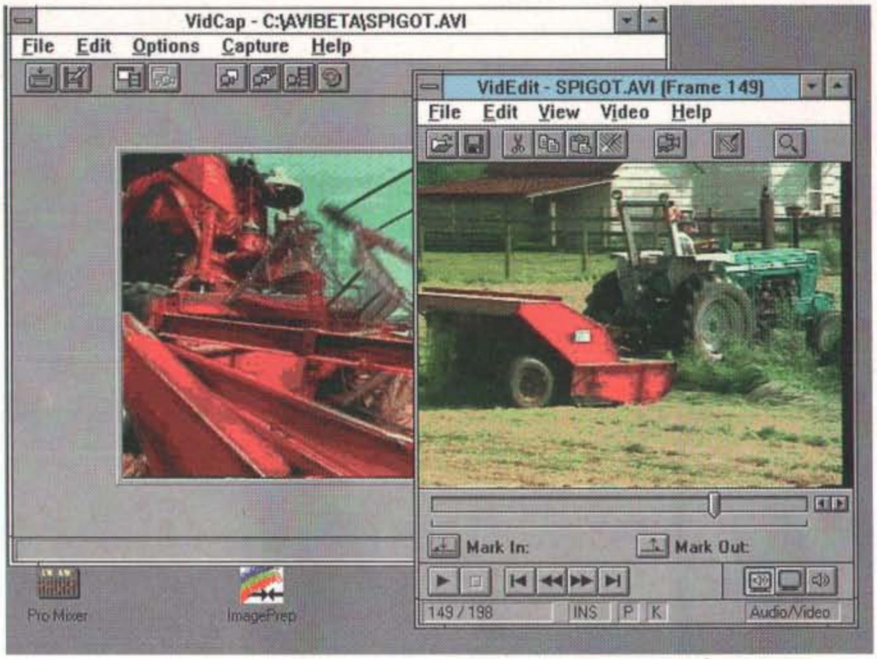
Windows Video Flows

SuperMatch, the part of SuperMac Technology that creates products for PCs, has done itself proud. Its latest product, **VideoSpigot for Windows**, brings to Windows users the image quality and ease of installation that its Mac predecessor carries. Built to run with Microsoft's Video for Windows, the video-capture and playback extensions for Windows 3.1, this newest VideoSpigot offers some key advantages that other video-capture boards don't have.

VideoSpigot for Windows is a single board with no jumpers or DIP switches. It occupies one interrupt—being a 16-bit board, it can be placed above IRQ (interrupt request) 7—and one 8-KB region of memory. That 8-KB relocatable buffer became a favorite of mine from the very beginning. When I looked at the beta version of Video for Windows (see "Microsoft's Small-Screen Debut," December 1992 BYTE, page 56), I was stymied by the inability of the capture boards that are supported by that release (including Video Blaster and Super Video Windows) to run in my system with 16 MB of memory installed. I had to get one of the PCs from BYTE's Multimedia Lab, a Uniq 486/50, *downsized* to 8 MB to accommodate the overlay boards.

Now I can get the Uniq system decked out again, because VideoSpigot's memory buffer can be located either below the 1-MB mark or in upper memory around the 15- to 16-MB area (which is where overlay boards typically go). VideoSpigot's installation dialog box has a "Scan" button that will hunt for a free 8-KB hunk of memory. Even though it failed to find any such free memory on my system, it worked fine when I gave it a handpicked address to search for.

Unlike most other current Windows digitizers, this board is *not* a video-overlay board. Its only lot in life is digitizing, and that's a plus. Because this board doesn't expect to be cabled to a VGA adapter's feature connector (as video-overlay boards do), you can use VideoSpigot with any kind of display you like. Overlay boards often get cranky in Super VGA modes, and they can get really cranky (read that as "stop working") at high resolutions. You can run an overlay board without its VGA connection, but the video often comes in misaligned because the VGA mode you're using can't be sensed. In contrast, VideoSpigot doesn't care what display you're using—just as long as you're using a Windows-compatible display board, you're in business.


VidCap - C:\AVIBETA\SPIGOT.AVI
File Edit Options Capture Help
VidEdit - SPIGOT.AVI [Frame 149]
File Edit View Video Help
Mark In:
Mark Out:
149 / 198
INS P K
Audio/Video
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Aside from all this, VideoSpigot's key advantage is the quality of its capture. The board uses extremely high quality digital-encoding hardware. SuperMac claims VideoSpigot will capture 30 frames per second at the standard 160- by 120-pixel window size and 15 frames per second at the 320- by 240- pixel window size. While I verified that it did indeed move faster than my Video Blaster, it was difficult to get a reliable measurement because of all the conditions that affect capture speed (disk fragmentation, disk cache, and memory are key variables).

When it comes to playback time, the board steps out of the way; there is no hardware acceleration of either the display or decompression. SuperMac has its own compressor/decompressor software that it claims does the standard set provided by Microsoft one better. This software plugs in as a Windows driver and offers higher compression ratios. In addition, according to SuperMac, it also offers better-looking video.

As with other Windows capture boards, the audio that accompanies your video is digitized through a separate connection to an MPC-compatible sound card. VideoSpigot connects to both composite and S-Video (Y/C) video devices through ports on the back of the card. Only one input is active at a time, and the capture driver lets you select an input manually or else senses which connection has an active signal and selects it for you.

VideoSpigot will be bundled with a collection of software from Asymetrix, including Multimedia ToolBook, Make Your Point, and MediaBlitz. A video editor isn't part of the bundle because a third-party editor (à la Adobe Premiere for the Mac) for Windows doesn't exist yet; Video for Windows does include some limited editing capabilities. VideoSpigot's ease of installation and use, relatively low cost, high-quality color, and enhanced compression software make it as obvious a choice for Windows users as it has been for Mac users.

—Tom Yager

THE FACTS

VideoSpigot for Windows
$499

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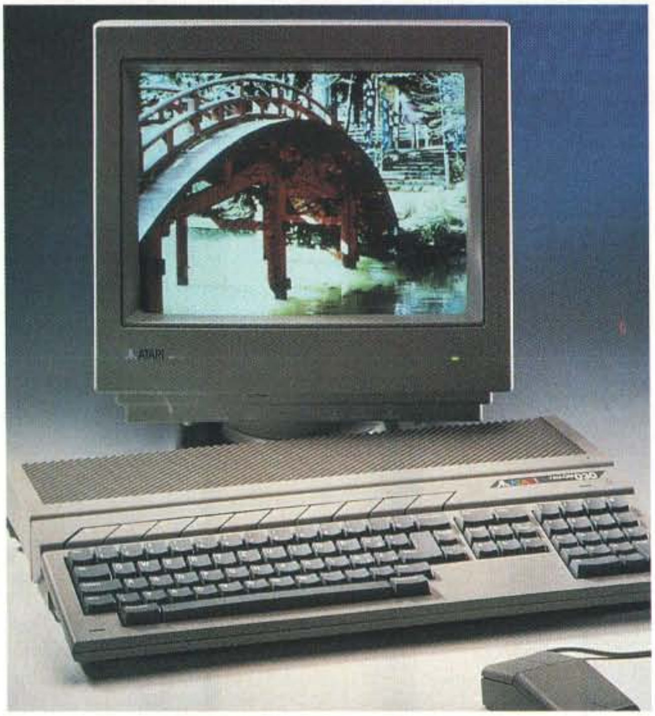
Atari's Falcon030 Leads the Pack



While IBM, Apple, and others are expected to introduce computers with DSPs (digital signal processors) later this year, the first company to ship a low-cost PC with a DSP is none other than Atari—the video-game company that once hit $2 billion a year in sales and then nearly collapsed in the mid-1980s.

Although Atari is smaller these days, it's still selling a line of computers. Atari's latest computer, the **Falcon030**, is a surprisingly versatile machine that points the way toward a new generation of multimedia computers. Given Atari's track record, it's hard not to be skeptical, but the Falcon really is something different.

Right out of the box, with no additional hardware required, you can attach the Falcon to a VGA monitor, a TV, a VCR, a camcorder, a stereo system, a pair of microphones, an electric guitar, a MIDI keyboard, or almost any audio/video device that accepts a patch cord. To add similar capabilities to any other PC would probably cost more than the price of the Falcon—$799 for the basic unit with 1 MB of RAM and a 1.44-MB floppy drive.

With the right software, you can mix multiple sound sources, apply special effects, and record audio on either a tape recorder or the computer's hard disk. If you choose direct-to-disk digital recording, the Falcon supports eight-track, 16-bit stereo at sampling rates of up to 50 kHz, exceeding the quality of CDs and DAT (digital audiotape).

The Falcon is also adept at handling video and graphics. Built-in video supports 65,536 colors at 640 by 480 pixels, with 262,144 possible hues. The computer accepts an external video synchronization signal for genlocking, and a special overlay mode lets you add titling and special effects. Composite video and RF outputs are standard. It wouldn't take much to turn the Falcon into a low-cost video workstation.

What makes all this possible is the 32-MHz Motorola 56001 DSP, coupled to a 16-MHz 68030 CPU and a pair of custom coprocessors. The DSP is the most important component. DSPs excel at processing fast streams of sampled analog data in real time, making them ideal for multimedia applications. Computers with DSPs can do a better job of manipulating music and speech, compressing sound and graphics, and communicating with analog devices. What's more, DSPs can work in the background, freeing the CPU for other tasks.

For example, the Falcon's DSP supports eight 16-bit DMA channels that operate in parallel, allowing simultaneous audio recording and playback. Standard audio interfaces include stereo I/O jacks and a pair of MIDI ports for attaching music keyboards and other MIDI devices.

Another port brings out the pins of the DSP bus. This makes the DSP accessible for a wide range of uses, including video digitizers and telecommunications. Also standard are a LocalTalk port for easy networking with Macs and a SCSI-2 port with DMA. The fast SCSI port is vital because the Falcon's internal 65-MB hard drive isn't nearly large enough for serious digital recording, which at CD quality gobbles up more than 7 MB per minute. With the SCSI-2 port, you can add as much storage as you can afford.

The Falcon runs a proprietary multitasking operating system and Digital Research's GEM. It's compatible with most software written for Atari's earlier ST computers, including a wide variety of applications for business, desktop publishing, and entertainment. There's a particular abundance of music software, and some of it's being rewritten to take advantage of the Falcon's DSP. Only a few DSP-driven programs were available for this evaluation, however, and they were still unfinished.

One program I tested was Musicom. I plugged an electric guitar into the Falcon and used Musicom to add flanging, harmonizing, equalizing, digital delay, and heavy-metal distortion—replacing hundreds of dollars' worth of special-effects pedals. Next, I digitally recorded a rhythm track onto the Falcon's hard disk. I used Musicom to play back the rhythm guitar, mix in a lead guitar, and record both parts on a tape recorder. And I did all this without any extra hardware.

Until now, the only desktop computers with integrated DSPs were the Next workstations, which also use the 56001 DSP from Motorola. IBM and Texas Instruments have developed a DSP called the MWave, which will appear in IBM's Ultimedia computers later this year. Apple has adopted AT&T's DSP3210 for its future Macs. With the Falcon030, Atari is offering a tantalizing and affordable preview of things to come.

—Tom R. Halfhill

THE FACTS

Falcon030
with 1 MB of RAM and a 1.44-MB floppy drive, $799; with 4 MB of RAM (expandable to 14 MB) and an internal 65-MB IDE hard drive, $1299

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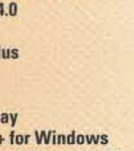

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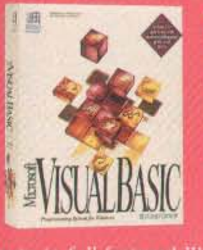

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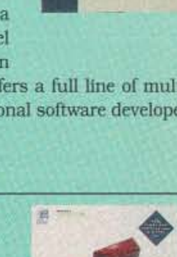

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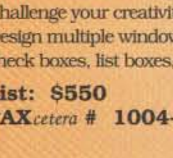

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QMS 1725: New RISC, Old Reliability

The network laser-printer market has never been a playground. But with intensifying pressure from relative newcomers such as Compaq and veterans such as Hewlett-Packard, QMS has found it necessary to update its powerhouse 17-page-per-minute QMS-PS 1700 with the **QMS 1725 Print System**.

Among the biggest improvements the 1725 offers is an Intel 25-MHz 960-CF RISC processor. With an on-board 4-KB instruction cache and 1-KB data cache, it's a step beyond the 960-CA of the 1700. This product is the first to use the CF chip, which Intel announced last May. And where the 1700 included Adobe PostScript Level 1, HP PCL4 (Printer Control Language 4), HPGL (Hewlett-Packard Graphics Language) 7475A/7550A, and CCITT Group 4 fax, the 1725 has repackaged and enhanced this PDL (page-description language) support.

In place of Adobe PostScript Level 1 is QMS PostScript Levels 1 and 2, emulations of PostScript that follow the Adobe specification. (QMS already offers this in the 8-ppm QMS 860 Print System it announced last summer.) PCL4 is also standard; QMS expects to offer PCL5 later. Emulations of Group 4 fax (often needed for compatibility with compressed files even though QMS PostScript Level 2 includes it) and HPGL are sold together on an optional ($250) ROM card that plugs into one of two slots in the front of the unit. DECnet users can purchase an LN03 Plus emulation for the 1700 or the 1725.

From the outside, the 1725 looks identical to the 1700. Before adding the two 500-sheet paper trays, the unit is a whopping 106 pounds. The prerelease version I looked at was fitted with 32 MB of RAM (8 MB comes standard), a $695 duplexing tray, a $795 internal 40-MB hard drive, and 38 of the 39 resident fonts the shipping product supplies. The 1700 comes with 45 fonts.

What the 1725 shares with its predecessor is a wealth of features that have kept the QMS presence strong in the market. The 1725 owes part of its appeal to the Canon NX engine, also present in HP's LaserJet IIIsi, and its 50,000-page-per-month duty cycle. A generous helping of interfaces keeps your options open: serial, parallel, LocalTalk, and a fourth you can use to connect directly to Ethernet (i.e., NetWare, EtherTalk, TCP/IP, or a combination DECnet and TCP/IP) or NetWare on token ring.

These interfaces would add up to little if not for the Crown technology QMS uses in several models to off-load document-processing duties from the host computer. The 1725, for example, lets you adjust the size of the buffers you've devoted to each interface to match expected traffic. Each interface can thus accept data simultaneously, spilling it over to common printer RAM or even to one or more hard disks (you can install up to six, counting external devices connected through the 1725's SCSI port). As much as 255 MB of data, if necessary, can spill over to disk, where it's treated as RAM.

Another important part of Crown is ESP (Emulation Sensing Processor) technology. A feature found in other vendors' products under different names, ESP analyzes incoming data and selects the appropriate language to keep you from having to switch settings in hardware or include software commands. A context-switching feature preserves the state of one emulation while you are using another.

Print jobs output alternately to the left and right edges of the 1000-sheet output tray to separate jobs. Multiple-copy runs are quickened through the 1725's storage of a page, in compressed form, in printer RAM to avoid the need for duplicative compilation and rasterization.

As for print quality, the 1725 offers 300 by 300 dots per inch or, for four times the dots for high-quality work, 600 by 600 dpi. Text output is crisp and legible even in small point sizes. Graphics images, notably at the higher resolution, are clean, and the curves are well delineated.

If the 1725 is any indication, anyone considering a printer for networks of up to 20 users may not have to look any further than QMS.

—Ed Perratore

THE FACTS

QMS 1725 Print System
$5995

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One challenge Lotus faces with **Freelance Graphics for Windows 2.0**, according to product manager Allison Parker, is getting people to use a presentation package. This may sound odd, considering that the market is crowded with excellent programs. As with word processors and spreadsheets, software companies are adding features to keep a step ahead of the competition.

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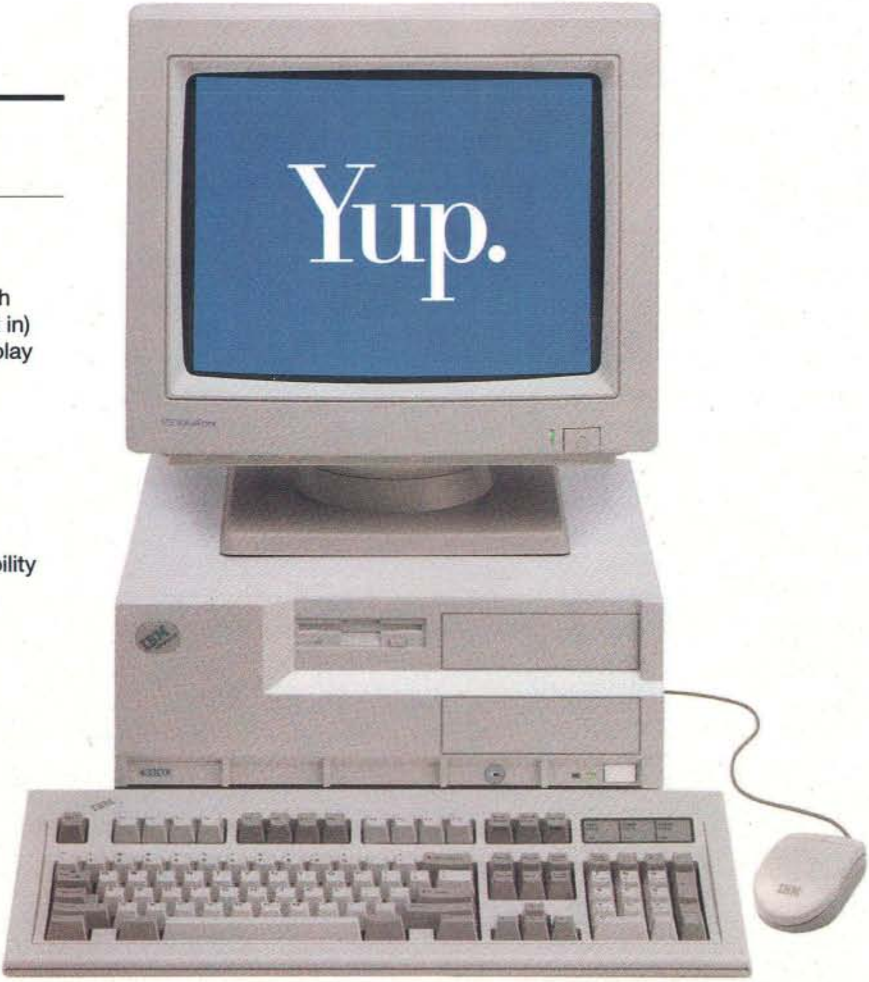

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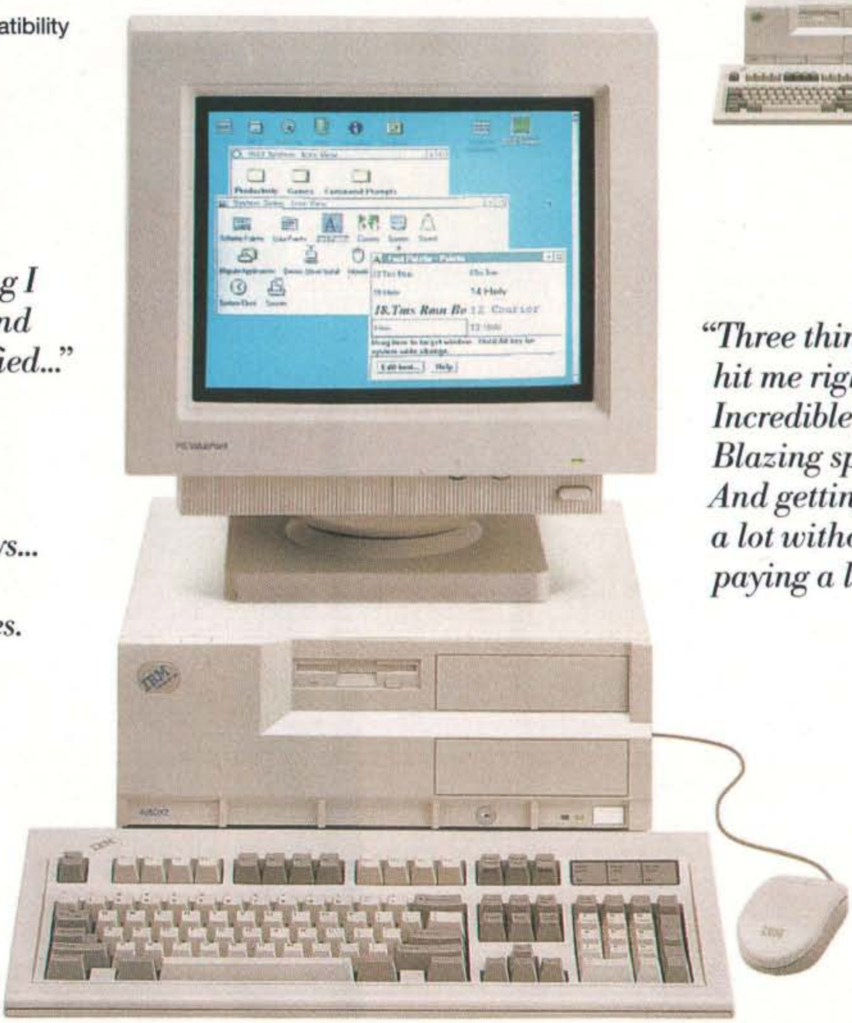

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[†] ThinkPad 300 and 700C systems and options are manufactured in Japan. PS/ValuePoint 6312, 6314 and 6319 Color Displays are manufactured in Korea.

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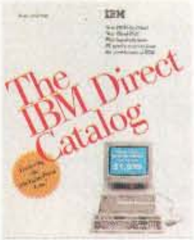

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ThinkPad 700 and 700C Options	**Price***
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IBM PS/2 8MB IC DRAM Card	$905
IBM ThinkPad 486SLC2 Processor Upgrade	$549
ThinkPad 300 Options	
Data/Fax Modem (2400 bps/9600 bps)	$330
Port Replicator	$120
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DOS 5.0, Stacker V2.0 and 386MAX 6.0	$135**
OS/2 2.0, Upgrade from DOS	$ 99
WordPerfect® 5.1 for DOS	$355
Lotus® 1-2-3® for DOS	$355
Microsoft® Excel™ 4.0 for Windows	$335
Lotus Freelance Graphics® for OS/2	$425

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IBM Personal Printer Series II, 2390	$385
IBM ExecJet® Printer, 4072	$775
500-Sheet Second Drawer for 4019(E), 4029	$295
PostScript® Option for 4019(E), 4029	$335

Technical support for IBM printers is provided by Lexmark™ International, Inc.

PS/ValuePoint Displays	
IBM 6312 Color Display	$405
IBM 6314 Color Display	$530
IBM 6319 Color Display	$660

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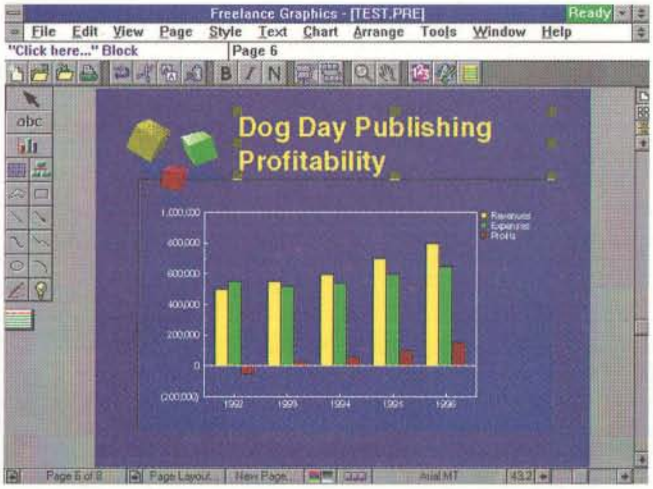
which businesspeople typically use for several hours a day. People use presentation packages only when they need to make a presentation, so the learning curve must be easier and the benefits more immediate. Lotus has taken a step in the right direction with Freelance Graphics for Windows 2.0.



While version 2.0 offers megabytes of advanced features, the beta software I tested was inviting and even fun to use. More important, I produced a presentation in about an hour. After I added some more complex charts and played around with transitions, the entire process took only about 3 hours—not bad for someone whose presentation package up until now has been QuarkXPress.

A tutorial called QuickStart walks you through the process of creating a presentation. While some concepts may seem elementary to presentation pros, beginners will appreciate the effort.

To help you get up and running quickly, version 2.0 provides 65 SmartMaster designs (12 more than the previous version), ranging from simple and elegant to bright and boisterous. The templates have been optimized for black-and-white presentations. According to Lotus, while many users create in color, their handouts or overhead transparencies generally appear in black and white. Two small icons at the bottom of the screen let you easily toggle between color and black-and-white views.

The slide show, or SmartShow in Freelance Graphics parlance, has been improved to let you jump to other pages in the presentation, launch other applications, and play sounds or movies. You can select from 32 transitional effects—rain, paintbrush, and more—as you move from page to page. You also can draw on the page while it's displayed—somewhat like John Madden doing his chalkboard analysis during NFL broadcasts.

Importing spreadsheets into Freelance Graphics for Windows 2.0 is a snap. You can import Lotus 1-2-3 and Symphony worksheets and Excel, dBase, and SYLK files. If you're like me, though, you may find it easier to simply create charts from scratch rather than importing them from spreadsheets. Either approach is painless.

To help you stay focused during presentations, you can add speaker notes to each slide. A small icon in the shape of an index card reminds you which screens you've annotated. A collapsible outliner makes it easy to create or modify a presentation. You can also print your outline.

What would a product be today without multimedia support? Freelance Graphics for Windows 2.0 lets you spruce up your presentations with sound and video.

After using version 2.0 for a week, I feel as if I have only scratched its surface. That's the beauty of it: Its features don't get in the way of preparing a presentation.

—Dan Muse

THE FACTS

Freelance Graphics for Windows 2.0
$495; upgrade from previous version, $150

System requirements:
A 286 or higher with Microsoft Windows 3.x running under DOS 3.1 or higher, EGA or better, a mouse, and a minimum of 3 MB of RAM (5 MB is recommended).

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 01242
(617) 577-8500
fax: (617) 693-1197
Circle 1172 on Inquiry Card.

A National Voice for the PC

With its first end-user product, National Semiconductor pulls no punches. The **TyIN 2000** packs a 2400-bps data modem, a 9600-bps fax, voice mail, and business audio onto a single PC adapter card. A set of Windows applications delivers these diverse functions to your desktop.

The voice-mail manager handles all your phone messages. When you open a mailbox from the menu or by double-clicking on a mailbox icon, a log of messages is displayed in a dedicated window. You can play back your messages, record a greeting, or send a memo to another mailbox. If you assign a password to the mailbox, an unauthorized person cannot open the window. The TyIN supports multiple levels of mailboxes, letting you set up an access menu. You can retrieve your messages from a remote phone, and the toll-saver feature issues an extra ring when there are no new messages so you can avoid long-distance charges.

A separate log tracks faxes. Double-clicking on an entry loads the fax image into a viewer. You can send faxes directly from the fax manager or from any other Windows application through a special printer driver. Faxing a file is then as simple as printing it. The card supports ECM (Error Correction Mode), a standard protocol on many dedicated fax machines that helps ensure high-quality output at the receiving end, and DFT (Document File Transfer), to enable the transmission of electronic files to other DFT-compliant fax boards. The TyIN automatically switches modes for reception of data, voice, or faxes on the same line.

Unlike other products in this category, the TyIN 2000 can also record and play back Windows audio (.WAV) files. You can append spoken comments to a document or spreadsheet that other users (with audio-capable systems) can listen to. Although the board provides jacks for an external speaker and a microphone, you really do not need either. You can record and play back audio notes through the telephone headset.

Thanks to the TyIN's programmable DSP (digital signal processor), in-house developers can build customized voice-mail applications. The DSP also makes it much easier to upgrade the board's functionality by delivering voice recognition, color fax support, or other upgrades to customers on a software disk, eliminating the need to exchange chips or ship the card to the developer.

I used the TyIN as my personal voice-mail system just prior to Comdex, when lots of vendors are calling BYTE editors, so it got a thorough workout. Although it had the usual rough edges I expect from beta software, all the functions worked as advertised. I missed some features found in similar products, such as Home Office's call-screening feature (you can listen to callers as they record messages and pick up the line if you want to) and the Complete Communicator's support for Caller ID. But, again, the TyIN's programmable design makes such feature upgrades easy to implement.

Perhaps the TyIN's most notable feature is its price. For $279, you get all the functions of a standard fax modem with voice mail and business audio to boot. For a business not large enough to support a dedicated voice-mail system, the TyIN 2000 is an excellent value.

—Stanford Diehl

THE FACTS

TyIN 2000
$279

National Semiconductor
P.O. Box 58090
Santa Clara, CA 95052
(800) 538-8510
(408) 721-5020
fax: (408) 721-7662
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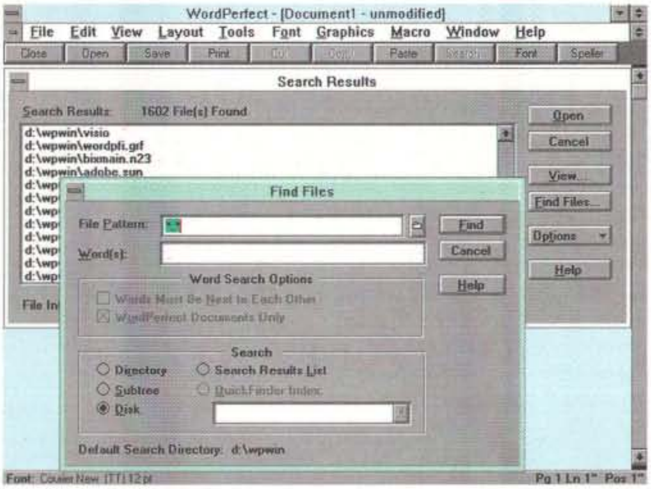
WordPerfect Spruces Up Windows


WordPerfect - [Document1 - unmodified]
File Edit View Layout Tools Font Graphics Macro Window Help
Close Open Save Print Cut Copy Paste Search Font Speller
Search Results
Open
Cancel
View...
Find Files...
Options
Help
Find Files
Find
Cancel
Help
Word Search Options
Search
Font: Courier New (TT) 12 pt
Pg 1 Ln 1" Pos 1"

Search Results: 1602 File(s) Found

d:\wpwin\visio
d:\wpwin\wordpfi.grf
d:\wpwin\bixmain.n23
d:\wpwin\adobe.sun

File Pattern: *.*
Word(s):

☐ Words Must Be Next to Each Other
☒ WordPerfect Documents Only

○ Directory ○ Search Results List
○ Subtree ○ QuickFinder Index
● Disk

Default Search Directory: d:\wpwin

WordPerfect is the leader of the pack in the DOS-based PC word processing software wars, but the Windows market is another story. WordPerfect doesn't dominate, but it's attempting to fight its way to the top with **WordPerfect 5.2 for Windows**. This product is an impressive upgrade to version 5.1.

In addition to adding a host of enhancements to the program, WordPerfect is also bundling Adobe Type Manager and Reference Software International's Grammatik 5 grammar checker. Among the version 5.2 enhancements are full OLE support, mail-enabling to support E-mail programs under the VIM and MAPI mail standards, new macros, import/export for Microsoft Word for Windows 2.0 and Lotus's Ami Pro 2.0, and the text indexing/retrieval feature called QuickFinder, which lets you quickly search file contents by keywords.

Take WordPerfect's stated memory requirement of 4 MB seriously. The beta version of WordPerfect 5.2 for Windows ran painfully slowly when working with only 2 MB of memory. However, after treating my Compaq Deskpro 386/20e to a long-awaited 4-MB memory upgrade, the updated version of WordPerfect took off. Running under 6 MB of RAM, WordPerfect 5.2 appeared nearly as fast as Microsoft Word for Windows 2.0, arguably its most formidable competitor.

One of the more intriguing aspects of version 5.2 is QuickFinder, for which WordPerfect is seeking a patent. With QuickFinder, which can be accessed easily from within the word processor itself, you can select certain files for indexing and then create an index that you can later search by filenames, keywords, phrases, or even Boolean operators. The indexes created by QuickFinder are relatively small. For example, indexing an entire 52-MB hard drive results in an index of about 1.6 MB in size. According to WordPerfect, QuickFinder builds index files equal to about 5 percent of the size of the selected files.

WordPerfect, which claims 1.5 million copies sold of version 5.1 for Windows, has thrown more than a few new bells and whistles into version 5.2. Users who purchased the DOS version of WordPerfect after April 1991 receive full licenses to the program under DOS, Windows, and OS/2. According to Devin Durrant, director of WordPerfect for Windows marketing, OS/2 is gaining momentum. And WordPerfect hopes to be the word processor of choice on that platform as well. ■

—Patrick Waurzyniak

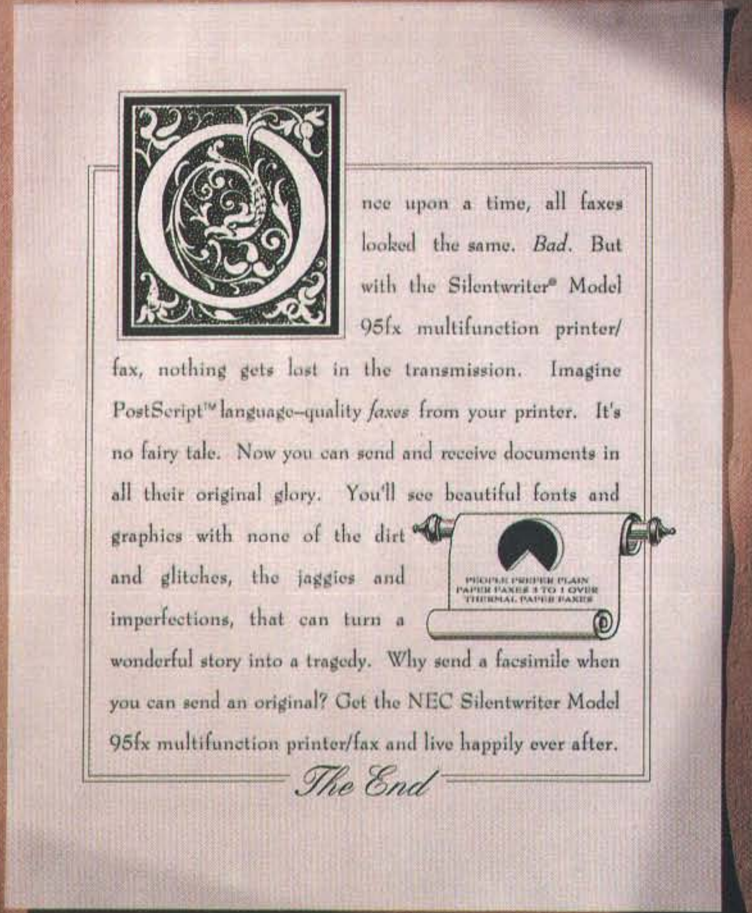
THE FACTS

WordPerfect 5.2 for Windows
$495

System requirements:
A 20-MHz 386 or higher with a minimum of 4 MB of memory.

WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(801) 225-5000
fax: (801) 228-5077
Circle 1174 on Inquiry Card.

Only one printer can give you this fax.



Once upon a time, all faxes looked the same. *Bad*. But with the Silentwriter® Model 95fx multifunction printer/fax, nothing gets lost in the transmission. Imagine PostScript™ language–quality *faxes* from your printer. It's no fairy tale. Now you can send and receive documents in all their original glory. You'll see beautiful fonts and graphics with none of the dirt and glitches, the jaggies and imperfections, that can turn a wonderful story into a tragedy. Why send a facsimile when you can send an original? Get the NEC Silentwriter Model 95fx multifunction printer/fax and live happily ever after.

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The End

Actual facsimile generated from a Silentwriter Model 95fx.

Our goal at NEC is the complete integration *of computers and communications. The Silentwriter Model 95fx is just one of many innovative products that help us to realize this goal. For example, we not only developed the first notebook computer with a built-in phone and fax, we make satellite dishes capable of sending data worldwide.*

And these facts.

1. A state-of-the-art 6 PPM laser printer equipped with Adobe's PostScript™ Level 2 and HP's PCL5.
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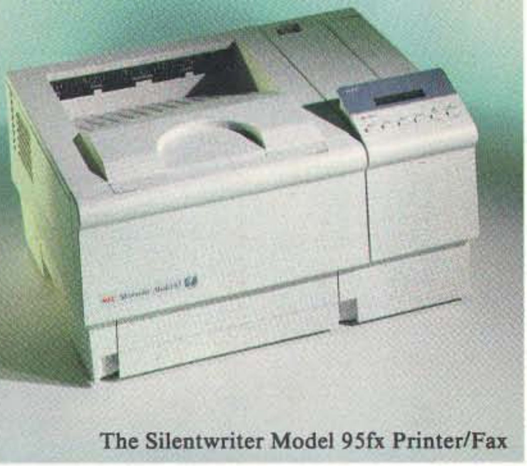
5. Under $2,349 (MSRP). Far less than you'd pay for any printer/fax multifunction combination.



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Because ↑ is the way you want to go. **NEC**

To upgrade your existing Silentwriter Model 95 printer with fax capability (U.S. only), or for more information about the Silentwriter Model 95fx, call NEC at 1-800-325-5500.

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CAD Power

The Tri-CAD DX2-VL graphics workstations, based on the 50- and 66-MHz DX2 processors, are VESA VL-Bus–compliant and include graphics accelerators with ATI's Mach-32 chips and 2 MB of VRAM (video RAM). This combination provides RISC-level performance with PC flexibility and ease of use, according to Tri-Star. The systems have 8 MB of RAM and 256 KB of secondary cache memory.

With a 32-bit VL-Bus Mastering SCSI-2 host that supports SCSI-2 hard drives of from 210 MB to 1.7 GB, the machines support up to seven SCSI devices. Other features include clock-doubling technology and 32-bit local-bus IDE hard drive controllers. A 17-inch Hitachi flat square color display is standard.

Price: Begins at $3595.
Contact: Tri-Star Computer Corp., Chandler, AZ, (602) 961-3401; fax (602) 961-4010.
Circle 1131 on Inquiry Card.

Power Notebook

With a 500-MB hard drive, Identity Systems' 386SXL-25 notebook computer is well equipped for receiving faxes and hosting large applications. The 7-pound portable has a backlit VGA gray-scale display, 4 MB of RAM, an internal floppy drive, two serial ports, one parallel port, DOS 5.0, Windows 3.1, and Works. Modems and alternate memory configurations are optional.

Price: $2995.
Contact: Identity Systems Technology, Inc., Richardson, TX, (214) 235-3330; fax (214) 907-9227.
Circle 1132 on Inquiry Card.

The Tri-CAD DX2-VL's graphics adapter provides noninterlaced resolutions of up to 1280 by 1024 pixels with 256 colors.

Portable Color

EuroPak's Eurocom 5500DX2C Super-Notebook has more power than many desktop systems. Packed into the 50-MHz 486DX2's 5.5-pound frame are a 120-MB hard drive, a floppy drive, 4 MB of RAM (expandable to 8 MB), and a passive-matrix triple-supertwist 9-inch LCD, capable of displaying 256 colors at 480- by 640-pixel resolution. Standard interfaces include two serial ports, a parallel port, and ports for an external VGA monitor, a keyboard, and more.

To save energy, the notebook has sleep and smart-sleep modes. The detachable battery pack provides power for up to 2½ hours. The docking station option includes two 16-bit slots, a keyboard port, two serial ports, and one parallel port.

Price: $3450; docking station, $300.
Contact: EuroPak International, Nepean, Ontario, Canada, (613) 721-3221; fax (613) 722-2767.
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Talk to Your Notebook

The custom-designed Wen 486 SuperNote-Voice color notebook includes a telemarketing-style headset with a microphone that lets you send verbal instructions to the unit. Wen's proprietary voice-recognition software features as many as 1000 isolated words or phrases with better than 98 percent accuracy. Also included are concurrent operation of voice recognition and unlimited text-to-speech synthetic voice output.

The notebook's basic configuration has 2 MB of RAM (expandable to 10 MB), 128 KB of ROM, and 8 KB of cache memory. It also includes a 60-MB hard drive and a 387 coprocessor socket.

Price: $4500 and up.
Contact: Wen Technology Corp., Elmsford, NY, (914) 347-4100; fax (914) 347-4128.
Circle 1134 on Inquiry Card.

First Computers

Canon's entry into the computer market brings with it two 25-MHz 486SX machines. The Innova 486 desktop is upgradable to all 486-based microprocessors, including the 66-MHz DX2. The system has a color Super VGA monitor, 4 MB of RAM, 8 KB of internal and 64 KB of external cache memory, a 130-MB hard drive, and dual floppy drives.

The 5.8-pound Innova 486NX color notebook is upgradable to a 50-MHz 486DX2 unit. It has 4 MB of RAM (expandable to 12 MB on-board), 8 KB of internal cache memory, a 120-MB hard drive, and a 1.44-MB floppy drive. The just-over-9-inch screen is a passive-matrix color VGA LCD with 16 colors. Interfaces include a PCMCIA expansion port and a PS/2 mouse port. A Logitech TrackMan mouse and a nickel-metal-hydride battery are standard.

Price: Innova 486, $1899; Innova 486NX, $3999.
Contact: Canon Computer Systems, Inc., Costa Mesa, CA, (800) 848-4123 or (714) 438-3000; fax (714) 438-3099.
Circle 1135 on Inquiry Card.

Canon's Innova 486NX.

CD-ROM Made Easy

Available in a slim portable case or as a cube, the Venturer CD-ROM drive conforms to the ISO 9660/High Sierra standard and is compatible with CD-ROM modes 1 and 2. A top-loading mechanism frees the front of the unit for a hi-fi audio CD-player control panel that lets you play music without PC software.

The Venturer features a proprietary interface or an optional parallel port interface for notebook compatibility. With the MS-DOS CD extension, the unit is multimedia applications–compliant. The data transfer rate is 150 KBps, and the average access time is 800 ms. The drive, which has a 2352-byte buffer, can read standard 12- and 8-cm CDs.

Price: $179.

Contact: North-East Microcomputer, Ltd., Markham, Ontario, Canada, (416) 513-6800; fax (416) 513-6802.

Circle 1136 on Inquiry Card.

Data in Large Chunks

Capable of up to 12 GB of uncompressed data storage via 12-mm proprietary DAT (digital audiotape) technology, the VDAT SCSI data-storage system provides more than 25 GB of compressed data storage at a 2-to-1 average compression ratio. Sustained data transfer rates for the unit reach 2500 KBps. The PC-compatible VDAT comes with 56-bit and full Reed-Solomon error-correction code.

Price: $11,995.

Contact: TenTime, a division of Laura Technologies, Inc., Chandler, AZ, (602) 940-9800; fax (602) 940-0222.

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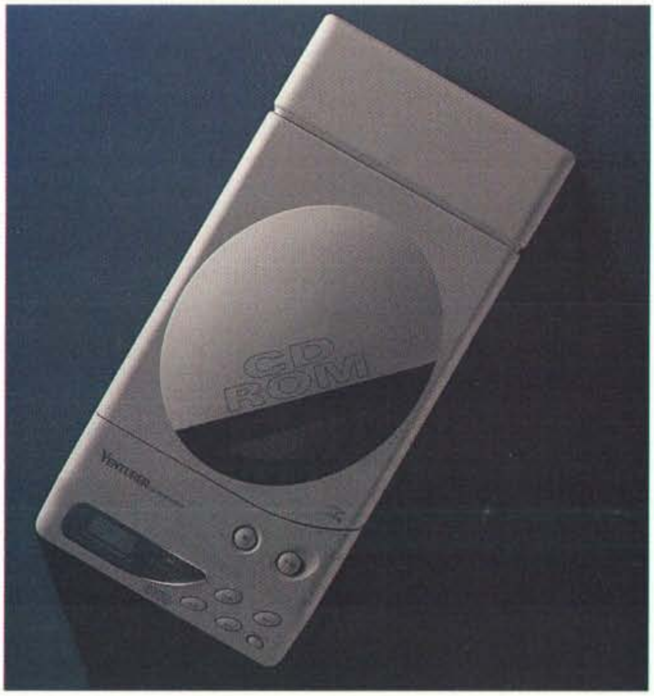

The Venturer CD-ROM has a 150-KBps data transfer rate, an 800-ms average access time, and a 2352-byte buffer.

Monitors for Different Uses

The HM-6421 21-inch, 2-megapixel-resolution color monitor has 1600- by 1280-pixel, 28-mm-dot-pitch flat-screen vertical scanning of 72 to 77 Hz. The monitor uses Hitachi's proprietary analog dynamic convergence circuitry for a misconvergence of 25 mm in the center viewing area and 35 mm in the perimeter. The company's patented Elliptical Aperture Dynamic Focus system passes electron beams through an elliptical rather than a round aperture in peripheral areas and then controls the beams for sharp images throughout the screen.

Price: $5495.

Contact: Hitachi America, Ltd., Office Automation Systems Division, Montvale, NJ, (201) 573-0774; fax (201) 573-7660.

Circle 1138 on Inquiry Card.

The High-Resolution Multi-Sweep circuitry of Image Systems' M21LMUMAX gray-scale monitor lets the monitor dynamically adjust to horizontal frequencies of 15 to 65 kHz or 48 to 105 kHz and a vertical frequency of 55 to 90 Hz. Noninterlaced display mode is available at resolutions of up to 2048 by 1536 pixels, and the video bandwidth is 200 MHz. You can manually adjust the display area to a maximum of 16 by 12 inches on the 21-inch screen. With its Mumetal protective shielding, the monitor can operate next to x-ray equipment without influence from magnetic flux.

Price: $5950.

Contact: Image Systems Corp., Hopkins, MN, (612) 935-1171; fax (612) 935-1386.

Circle 1139 on Inquiry Card.

A flat square display and temperature-controlled color matching to printed output are two reasons for the ViewSonic 15's appeal. The display's 1024- by 768-pixel resolution has refresh rates of up to 76 Hz, and the 28-mm dot pitch provides depth and clarity to images. Invar shadow-masked technology makes the images bright and crisp. The monitor automatically adjusts to horizontal scan frequencies of 30 to 64 kHz. You can store up to 26 programmable settings in memory on the monitor, which is IBM- and Mac-compatible.

Price: $849.

Contact: ViewSonic, Walnut, CA, (800) 888-8583 or (909) 869-7976; fax (909) 869-7958.

Circle 1140 on Inquiry Card.

Port Sound to Your System

A plug-and-play external sound system, Digispeech Port-Able Sound adds CD-quality audio to your PC. The system automatically loads its software drivers when you initially plug it into your computer's parallel port. With a pass-through that lets your printer continue functioning, Port-Able Sound senses whether files going through the port are intended for the printer or for itself.

System features include a built-in speaker and microphone, an on/off switch with an LED that indicates when the sound is turned off, input jacks for a CD player, output jacks for external speakers, audio stereo sound, and Lotus Sound software. The system is compatible with Windows 3.1, Windows Multimedia Extensions, SoundBlaster Pro, and Pro Audio Spectrum.

Price: $189.95.

Contact: Digispeech, Inc., Placerville, CA, (916) 621-1787; fax (916) 621-2093.

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Speed and Color on Plain Paper

Able to print 2 ppm, the Phaser 200i and Phaser 200e 300-dpi printers print on transparencies and common office paper. The printers use Tektronix's new P2T2 technology, which incorporates proprietary image-processing techniques and a custom transfer ribbon to apply a transparent primer coat on the paper only where needed. The printers also use Tektronix's proprietary TekColor color management and image-rendering technologies and offer the TekColor Display Adjust and Blue Adjust options.

The Phaser 200 Series printers include parallel, serial, and AppleTalk ports with automatic switching among them. The company's 4511A network interface provides TCP/IP and DECnet connectivity, and an optional EtherTalk interface is available for the Phaser 200i. The Phaser 200i comes with 6 MB of expandable memory; the Phaser 200e has 4 MB. In addition to PostScript Level 2 page description software, the printers support HPGL (Hewlett-Packard Graphics Language).

Price: Phaser 200e, $3695; Phaser 200i, $5995.

Contact: Tektronix, Inc., Wilsonville, OR, (800) 835-6100 or (503) 682-7377.

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The Tektronix Phaser 200 Series workgroup printers, sized to fit on your desk, run in unattended mode.

Network Color Printing

The Codonics NP-600 color network printer uses dye-sublimation technology to produce photographic-quality images. Designed to work with any homogeneous or heterogeneous TCP/IP network, the printer connects to existing Ethernet or token-ring networks. It uses the industry-standard TCP/IP protocol to print files originating from DOS, Unix, and DEC VMS systems. Host computers do not require any special software drivers.

The printer automatically identifies the transmitted image's file format by recognizing header information embedded in every file, so you don't need to specify the file format types. Image file formats that the Codonics NP-600 recognizes include TIFF, GIF, PCX, Macintosh PICT, Sun raster, Portable Pixmap, and X11 Bitmap. With 16.7 million simultaneously printable colors, the printer can produce continuous-tone format prints.

Price: $12,500.

Contact: Codonics, Inc., Middleburg Heights, OH, (800) 444-1198 or (216) 243-1198; fax (216) 243-1334.

Circle 1271 on Inquiry Card.

The Codonics NP-600.

Rugged Forms Printer

A high-speed, high-precision, dual-head impact printer designed for prolonged printing of multiple forms and heavy card stock, the TXP-800 form printer feeds, prints, and sequentially stacks forms, tickets, or cards. The nine-pin dot-matrix printer achieves burst speeds of up to 415 cps for 231 lpm.

The TXP-800's bit-mapped graphics capability lets you print at densities of 60, 120, and 240 dpi. You can also print bar code graphics of dot-matrix quality at high-density settings and set character spacing at 10, 12, or 17 per inch. The printer includes IBM Proprinter emulation with simplified programming instructions.

Price: $1925.

Contact: CTSI International, Inc., Ronkonkoma, NY, (516) 467-1281; fax (516) 467-2033.

Circle 1143 on Inquiry Card.

Print Graphics on This One

Brother's HL-10PS 300-dpi laser printer incorporates the company's BR-Script PostScript language interpreter, which also provides full support for Adobe Type 1 and Multiple Master fonts. In addition, the HL-10PS emulates the HP LaserJet III.

Standard features on the 10-ppm printer include automatic interface and emulation switching, 37 resident fonts, high-resolution control, and data compression. Standard interfaces include Centronics parallel, AppleTalk/RS-422A serial, and RS-232 serial ports. The HL-10PS supports unlimited gray shades in BR-Script mode and 64 shades in PCL (Printer Control Language) mode. The display and control panel tilts upward for ease of operation and readability; printer messages can be set in six languages.

Price: $2395.

Contact: Brother International Corp., Office Systems Division, Somerset, NJ, (908) 356-8880; fax (908) 356-4085.

Circle 1144 on Inquiry Card.

Print in Pantone Colors

The SpectraStar Q10 color thermal wax-transfer printer features Pantone-certified color matching and a three-color ribbon. The PostScript Level 2–compatible printer has 6 MB of RAM (expandable to 10 MB) for print spooling—letting the unit store copies of a document in memory—and a 20-MHz RISC processor. The printer supports PCs, Macs, and shared environments.

Price: About $6634 (£4350).

Contact: Reflex, Ltd., Reading, Berkshire, U.K., +44 734 313611; fax +44 734 314439.

Circle 1145 on Inquiry Card.

Why do they call it a dongle?

He wasn't famous. He didn't drive a fancy car, but dressed in his favorite Comdex T-shirt and faded blue jeans, he set out to change the course of the computer software industry. Quite a task for a lonely software developer.

Sitting in front of his computer, drinking pots of coffee and smoking cartons of cigarettes, he'd write pages of code.

It took time. Years in fact. But he did it. He wrote the most powerful computer program in the world. Now came the hard part. Selling it.

The Most Powerful Program in the World

Determined to make those long years pay off, he called on every distributor, VAR and dealer in the world. He drove from Beantown to San Diego. Flew from Dublin to Borneo. Everyone loved the program.

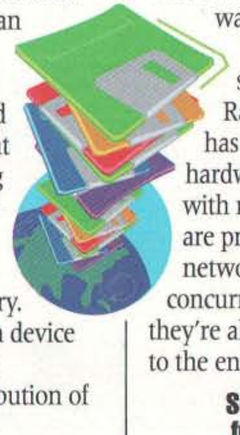
So he sold a few. Only a few.

Back in Boston he waited. After a long year with only 13 orders he set out to see what happened. As he drove across the country and flew around the world he discovered everyone knew about his program. Everyone had it too.

The Global Marketplace

From Paris to Prague, his program was everywhere in Europe. When he got off the plane in Hong Kong he found his program stacked to the ceiling in every computer store. Amazed in disbelief, he bought a hundred cartons of cigarettes and a hundred pounds of Indonesian coffee and flew back to Boston.

Beaten, battered and bruised he went back to the drawing board. This time he would really change the face of the software industry. He would develop a device that would prevent unauthorized distribution of software programs.



Call It What You Like

He developed a hardware key. His peers applauded his efforts. Finally, a solid solution for revenue protection.

But he didn't know what to call it. He thought of naming it after an exotic place he visited in his travels. Madagascar was a bit too long, though.

"Name it after you, Don!", urged his peers. So he did. Soon everyone was calling the key a dongle, after Don Gall— the lonely software developer who did what he had to do.

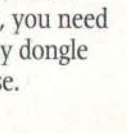
You've Come A Long Way, Baby

Today, dongles are different. Fact is, they've come a long way. Leading the industry with security solutions, Rainbow Technologies has changed the face of hardware keys. They work with multiple applications, are programmable and network versions control concurrent usage. And they're always transparent to the end-user.

Sentinel Family from Rainbow

Truth is, more and more developers are using keys. And the Sentinel Family is the most widely used in the world. In fact, over 10,000 developers use Sentinel from Rainbow. Why? They are simply the most effective, reliable and easy to implement keys on the market.

Learn more about securing your software and how keys provide developers with extra value. Call for a free copy of **"The Sentinel Guide to Securing Software."** And see just how easy it is to install a hardware key into your application in just minutes. Try it with our low cost Sentinel Evaluation Kit. Order one for your DOS, OS/2, Windows, Macintosh or UNIX based application.



And remember, when you need a dongle, you need Sentinel — the only dongle Don Gall would use.

For your free guide to securing software, call your local office or distributor listed below.

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Securing the future of software

Some call it a dongle. Those who know, call it Sentinel.

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Circle 430 on Inquiry Card.

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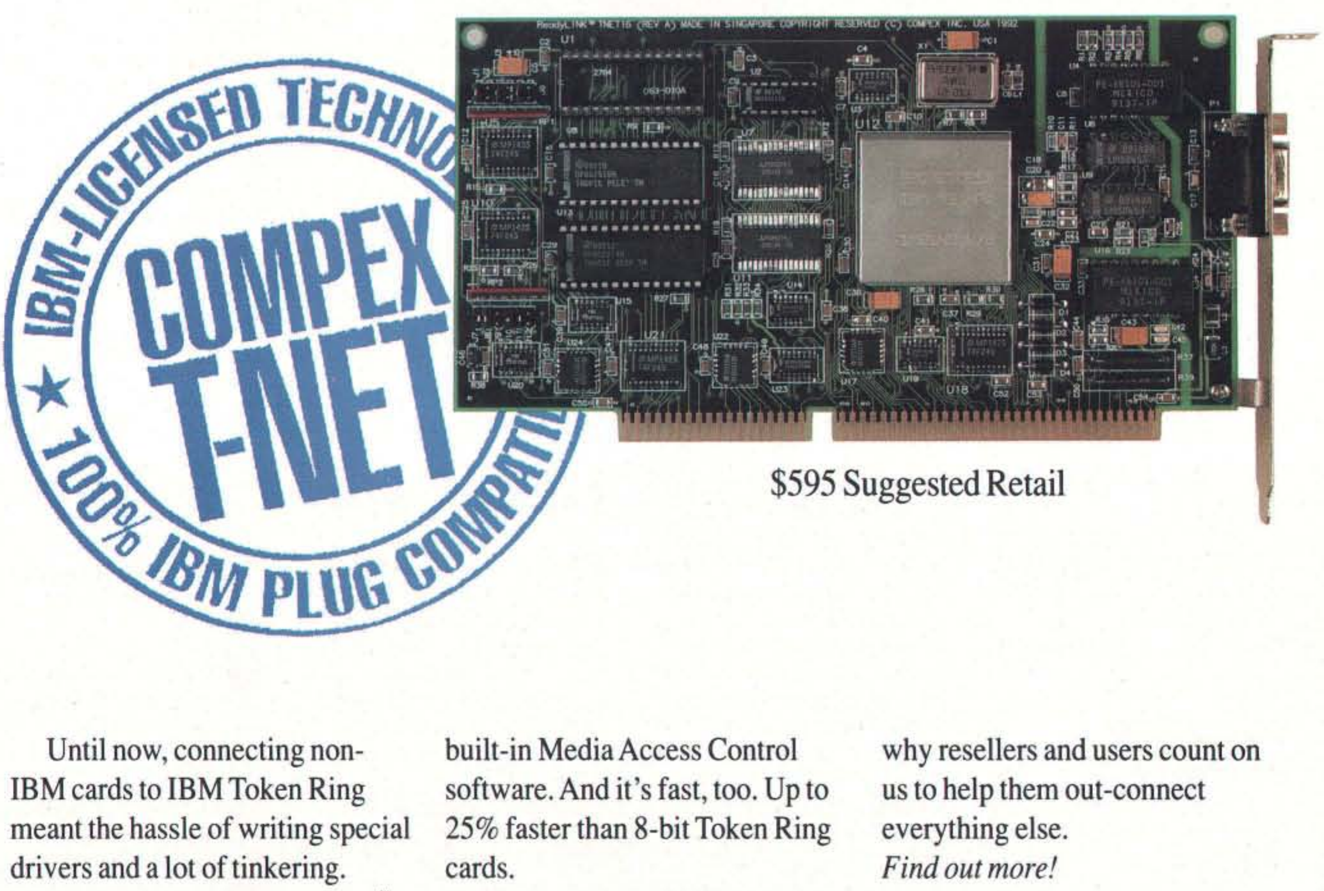
NEW COMPEX T-NET. FINALLY TOKEN RING THAT'S TRUE BLUE.



$595 Suggested Retail

Until now, connecting non-IBM cards to IBM Token Ring meant the hassle of writing special drivers and a lot of tinkering.

But the new Compex T-NET™ Token Ring card ends all that. Because it's 100% plug-compatible with IBM.

T-NET is one of the first with National's hot TROPIC™ chipset that's true blue right down to the built-in Media Access Control software. And it's fast, too. Up to 25% faster than 8-bit Token Ring cards.

TROPIC
DP8025 Token-Ring Protocol Interface Controller
National Semiconductor
Lab Certified Token-Ring Design

Sixteen bit ISA T-NET is available now. A MCA version will be available soon. And with a $595 retail price, an IBM-compatible Token Ring network has never been so affordable.

Compex T-NET. First to market with IBM plug compatible Token Ring. That's why resellers and users count on us to help them out-connect everything else.

Find out more!
(714) 630-7302
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Circle 405 on Inquiry Card (RESELLERS: 406).

Full-Motion Video

Windows 3.1–compatible, the VideoSurge 24-bit full-motion video board has audio pass-through and lets you select your video source from NTSC, SECAM, or PAL. Super-VHS is available as an option.

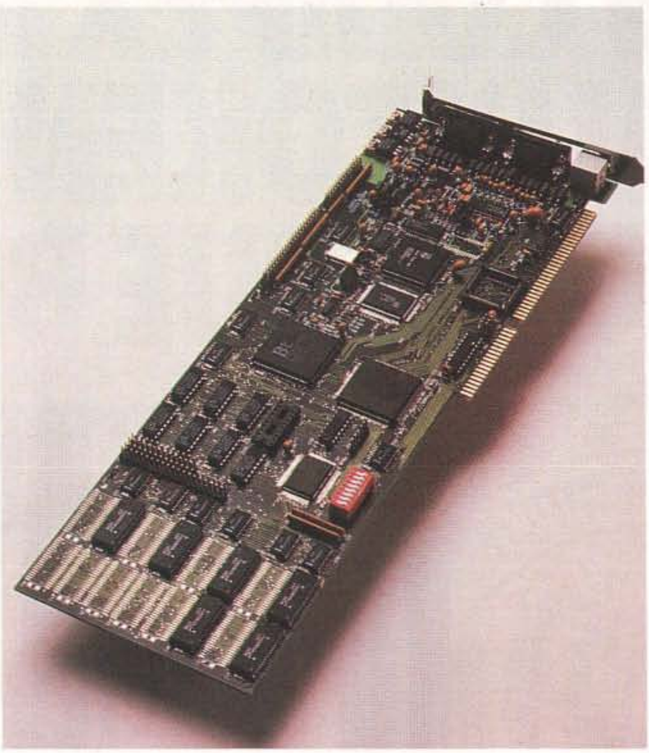
You can scale the video windows to any size, zoom them, and choose to have your scaled image fit or not fit in windows. If you choose the latter, you can do real-time panning and framing to display only a portion of the video. The board supports Super VGA resolutions of up to 1024 by 768 pixels.

As a video capture board, VideoSurge captures images into graphics file formats such as Bitmap, PCX, Targa, and TIFF. You can individually select and control the board's three sets of stereo inputs, each with volume, bass, treble, and balance control.

Price: $995; with S-VHS input, $1095.

Contact: Aitech International, Milpitas, CA, (800) 882-8184 or (408) 946-3291; fax (408) 946-3597.

Circle 1272 on Inquiry Card.



The Aitech VideoSurge is designed to function as a system or as an individual board with specific functionality.

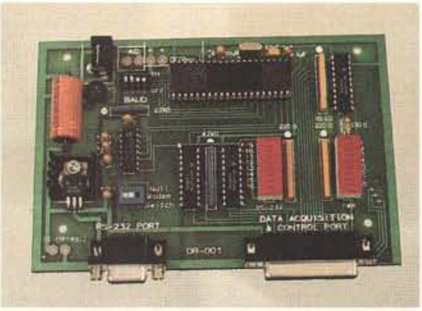
Digital I/O Control

The Quick Control Board puts data acquisition and control capabilities in your PC or Mac via the RS-232 port. Each of the board's 16 digital I/O lines has its own LED. Four 8-bit A/D converters can digitize signals between 0 and 5 V. At 19,200 bps, individual lines can be set up at 1920 state changes per second and read at 960 samples per second; A/D converters can also be read at 960 samples per second. Other features include a built-in null-modem switch, and two auxiliary 5-VDC power outputs drive external devices.

Price: $220.

Contact: Intelligent Automation, Inc., Rockville, MD, (301) 990-2407; fax (301) 990-2409.

Circle 1274 on Inquiry Card.



Intelligent Automation's Quick Control Board.

Resolution Boost

Get 600- by 600-dpi resolution and automatic network capability on your Hewlett-Packard LaserJet II Series printer with the ImageUp board. The board installs in the base of the printer to replace the printer's controller board.

Based on a Weitek XL-8220 25-MHz processor, ImageUp includes AppleTalk, parallel, and serial interfaces. NewGen's Automatic Recognition Technology automatically switches between protocols for shared-resource printing and handles switching among PostScript, PCL 4, and HPGL files without driver modifications.

Price: $1495.

Contact: NewGen Systems Corp., Fountain Valley, CA, (714) 641-8600; fax (714) 641-2800.

Circle 1273 on Inquiry Card.

DSP-Based Multimedia

An accelerator board that's a DSP (digital signal processor)–based multimedia application development platform, the QuantumDSP board is based on AT&T's 27.5-MFLOPS DSP3210. With VCOS (Visible Caching Operating System) and VMDE (VCOS Multimedia Development Environment), the board lets designers implement PC-based functions such as data and fax modems, audio and image compression, and CD-quality stereo. The DSP and the host PC can access the 2 MB of 70-second DRAM on the ISA-compatible board.

Price: QuantumDSP, $595; VMDE, $3000; DSP3210 design tools, $2000.

Contact: Communication Automation & Control, Inc., Allentown, PA, (800) 367-6735 or (215) 776-6669; fax (215) 770-1232.

Circle 1275 on Inquiry Card.

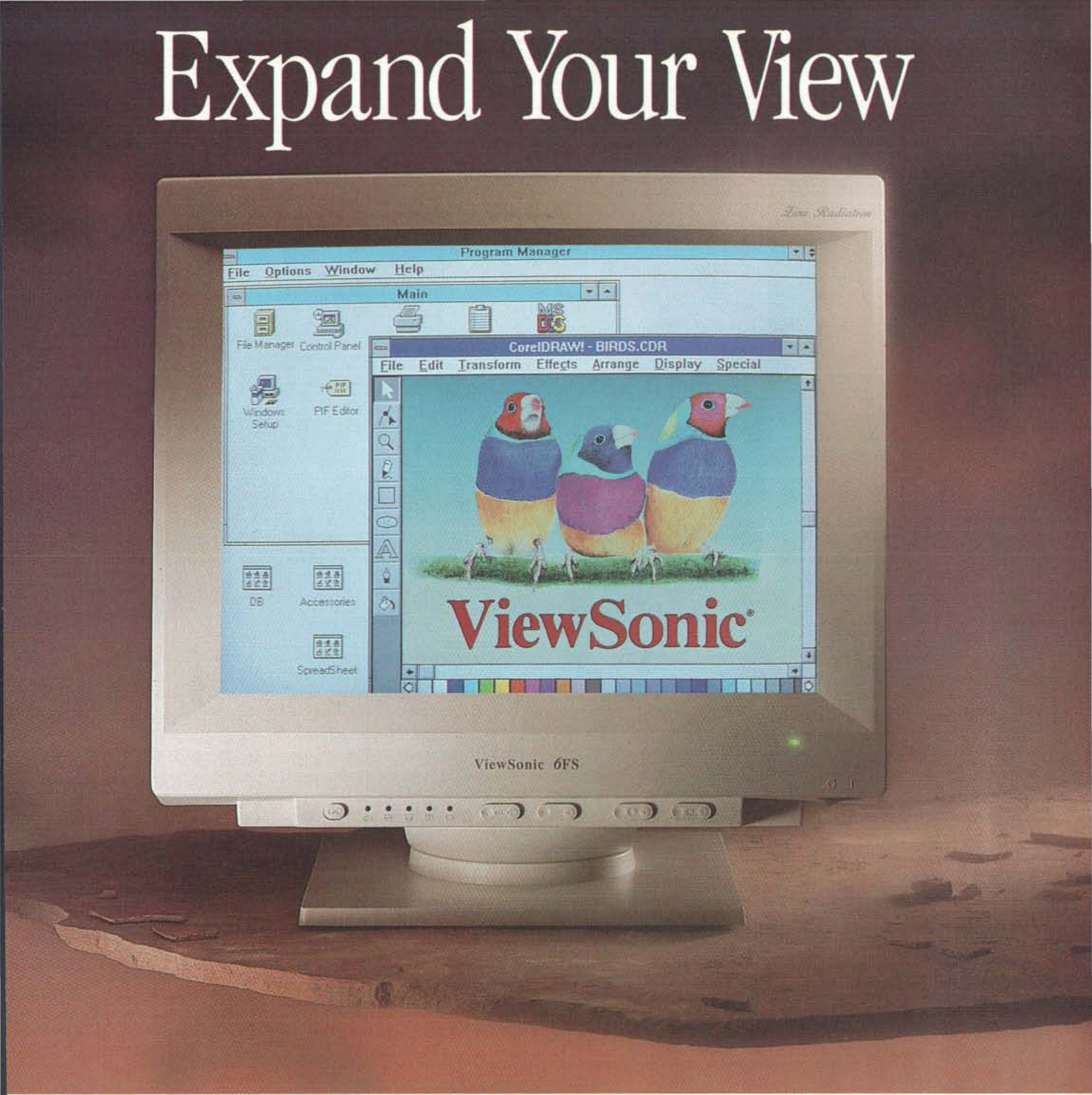
Put Your Graphics on TV

VGA2TV Pro displays computer graphics on a TV screen or VCR in up to 256 colors. The board supports NTSC or PAL; it overlays PC graphics on an input video source such as a VCR and outputs them onto videotape or TV. Compatible with any VGA board with a standard feature connector, the board features a full-frame buffer and supports text and graphics at up to 640- by 480-pixel resolution.

Price: $895.

Contact: Genoa Systems Corp., San Jose, CA, (800) 934-3662 or (408) 432-9090; fax (408) 434-0997.

Circle 1276 on Inquiry Card.



Yes, it's definitely time you expanded your view to the non-interlaced 15" ViewSonic 6FS monitor.

For one thing, you get 36-percent more viewing space than with a standard 14" monitor. And, since you can display more information on the screen with the larger 15" flat square screen, this is an ideal monitor for Windows, Graphical User Interface (GUI) and desktop publishing environments.

Thanks to the ultra high 72Hz refresh rate with resolution up to 1,024 x 768, the ViewSonic 6FS produces the most vivid and precise **flicker-free** image anywhere. In addition, the non-glare screen reduces irritating reflections.

The monitor, compatible with all standard resolutions, features 32 programmable modes with digital controls to store and customize the display to fit your specific needs. It also is certified to meet strict MPR-II Swedish certifications for low emissions, which makes it environmentally safe. It's a fact– the ViewSonic 6FS offers special features normally available only on larger, more expensive monitors.

Expand your view, not your budget, with the affordable 15" ViewSonic 6FS monitor.

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Circle 146 on Inquiry Card (RESELLERS: 147).

NEWS

WHAT'S NEW • OTHER HARDWARE

Windows Command and Control

A self-contained command center for use under Windows, the PowerTrac trackball system includes a two-button mouse, a trackwheel, and three programmable buttons. The PowerTrac is designed to intuitively enhance your ability to interact with Windows 3.1 applications.

TRAC.DRV, the Windows 3.1 control panel driver, provides user-definable ballistic gain, tracking speed and sensitivity, button functionality, drag lock assignment, and AutoDrag control. AppTrac software for Windows automatically senses which application is active, allowing the PowerTrac to respond with commands for the proper Windows application as you switch among them.

Price: $149.

Contact: MicroSpeed, Inc., Fremont, CA, (510) 490-1403; fax (510) 490-1665.

Circle 1277 on Inquiry Card.

The PowerTrac trackball system includes release 4.0 of MicroSpeed's Precision Pointer device driver software.

The Travel Connection

The Konexx Kit provides all the tools you need to connect your fax modem to any telephone in the world. Once connected, you can communicate at speeds up to 9600 bps. The kit includes the Konexx Koupler Model 203, a Merlin Phone Adapter, and a 9-V battery.

Price: $169.

Contact: Unlimited Systems Corp., San Diego, CA, (800) 275-6354 or (619) 277-3300; fax (619) 277-3305.

Circle 1278 on Inquiry Card.

The Konexx Kit.

Toss Out the Clock Battery

With the Permanent Power Pack (model PPP-001), you no longer need to replace your PC's clock battery. In place of the battery, the IC-based unit manages input power and regulates output power for the life of your PC. Installation requires no PC modifications, according to the company.

Price: $49.95.

Contact: MicroApps, Sunnyvale, CA, (408) 735-1015.

Circle 1279 on Inquiry Card.

Receive Faxes by Moonlight

Resembling a normal font cartridge, the Moonlight PrinterFax cartridge lets you receive faxes on a Hewlett-Packard LaserJet printer. The cartridge plugs into any HP LaserJet Series II, IID, IIP, III, IIID, or IIIP printer to give you plain-paper fax capability. Able to switch automatically between printer and fax modes, the cartridge provides precise date and time stamping.

Price: $259.

Contact: Moonlight Computer Products, Inc., San Diego, CA, (619) 625-0300; fax (619) 625-0199.

Circle 1280 on Inquiry Card.

Safe CD-ROM Movement

Now you can safely move your CD-ROM discs between their storage cases and your CD-ROM drive. The Disclift acts as an extension of your hand to let you handle the disc by its outer edges or engage the disc from its center. The lightweight device adapts to carousel players, magazine cartridges, and CD-computer caddies.

Price: $4.99.

Contact: The Audio File Co., Phoenix, AZ, (800) 662-0224 or (602) 272-2809.

Circle 1281 on Inquiry Card.

Digital Battery Management

A digital on-line battery backup device, the Perfector Series UPS (uninterruptible power supply) uses all incoming power and converts it to a simple energy level. A processor then converts the imperfect power into perfect AC power.

Price: $1599.95.

Contact: DSK, Inc., Orem, UT, (801) 224-4828; fax (801) 224-5872.

Circle 1282 on Inquiry Card.

Cable Diagnostician

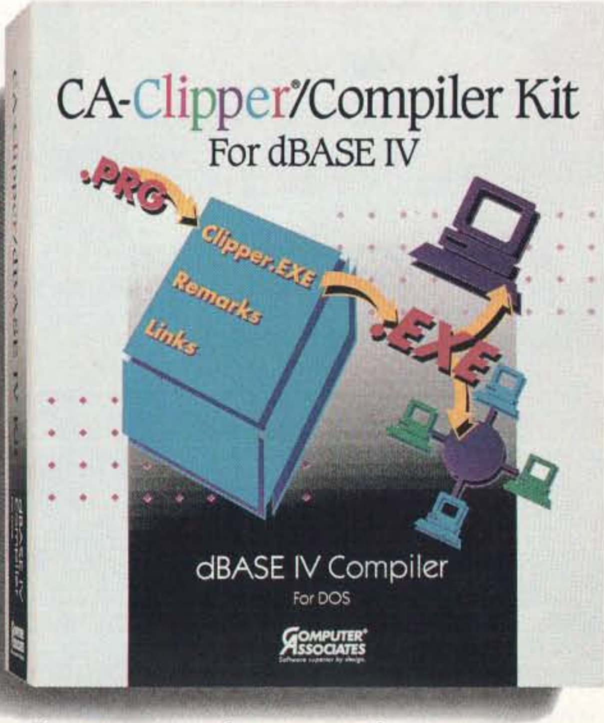
A hand-held network cable diagnostics and certification tool for coaxial and unshielded twisted-pair cable, the MT350 Scanner is designed for multiple types of networks. You can print the results to a portable printer, download them to the scanner's PC-based CMS (cable management system), or integrate them into any database.

Price: Scanner kit, about $4575 (£3000); CMS, about $534 (£350); portable printer option, about $450 (£295).

Contact: M-Group, London, U.K., +44 81 877 1711; fax +44 81 874 7265.

Circle 1283 on Inquiry Card.

Your dBase IV Compiler Has Arrived.



Finally.

Four years after Ashton-Tate promised it to you, CA is proud to deliver the CA-Clipper/Compiler Kit you've been waiting for.

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DATA BASED ADVISOR
Readers Choice Award

Readers of Data Based Advisor awarded first place to CA-Clipper 5.01 for Best XBase Compiler, Best Development Language and Best Application Development Product.

Now you can compile most dBASE IV applications in just three easy steps. First, create an application using all the dBASE IV tools you're already familiar with. Next, test and optimize the code to ensure it performs to specifications. Then use the DPREP program to compile it and produce an executable, .EXE file that gives you all the speed and efficiency CA-Clipper® is famous for.

The CA-Clipper/Compiler Kit For dBASE IV provides compatibility and database interoperability with most dBASE IV applications. And it's implemented using the open architecture of CA-Clipper, including the preprocessor, the Extend System and the RDDs.

Call 1-800 CALL CAI for the name of your nearest dealer and a free statement of direction entitled "The Future of Xbase". Call right now.

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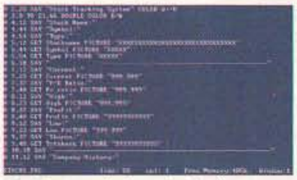
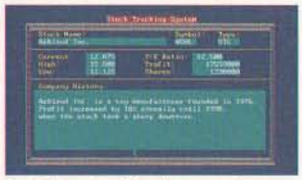
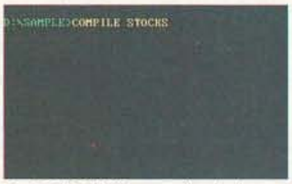


Step 1. Create applications using familiar dBASE IV tools and utilities, or even the dBASE IV Applications Generator.



Step 2. Test and optimize code to ensure it performs according to specifications.



```
D:\SAMPLE>COMPILE STOCKS
```

Step 3. The COMPILE command invokes the DPREP program. If no errors are detected, the batch file launches compile and link procedures, producing an executable, .EXE file.

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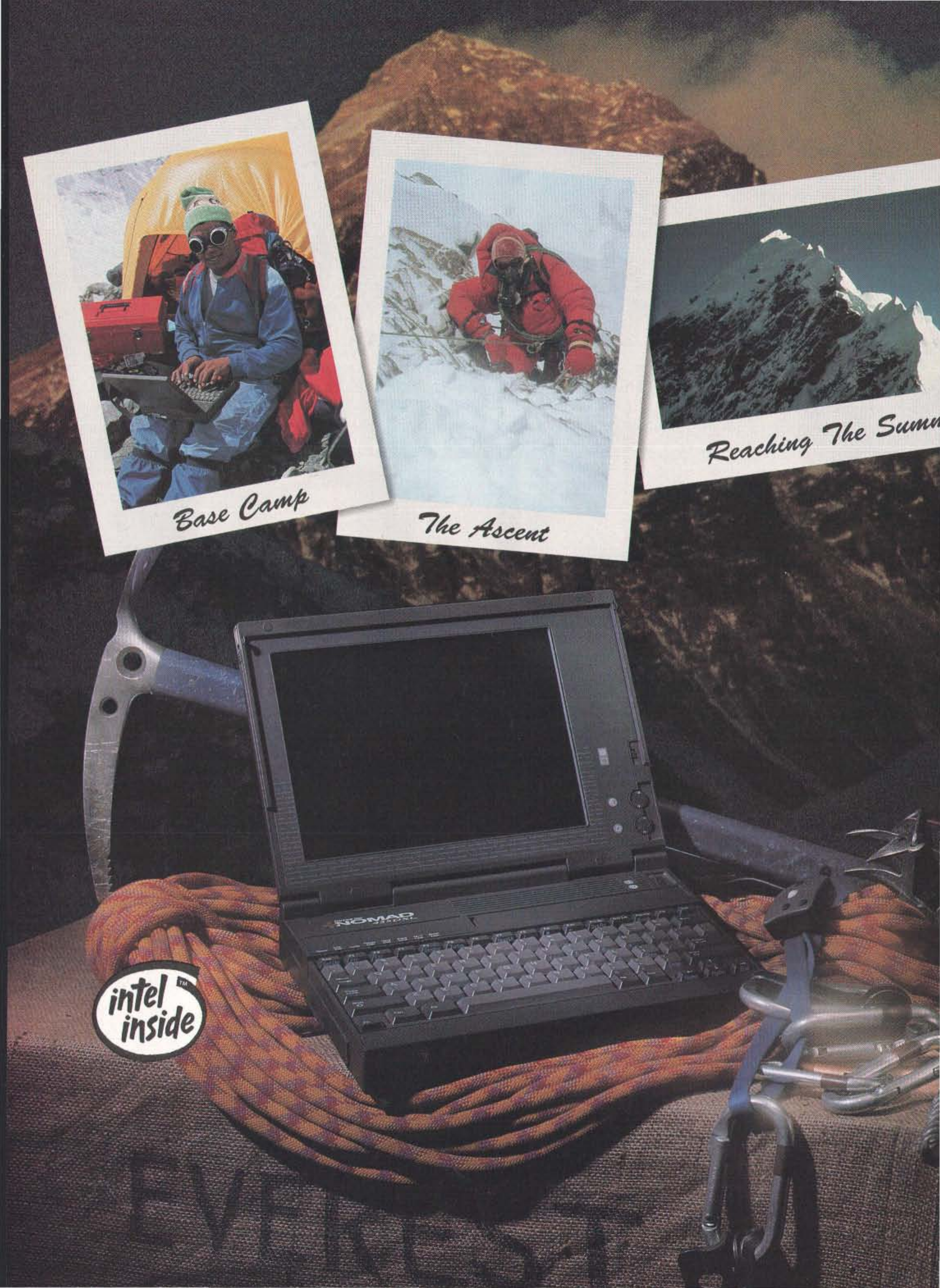
Circle 76 on Inquiry Card.


Base Camp
The Ascent
Reaching The Summ
NOMAD
intel inside
EVEREST

Going to Extremes

If you want to know what the Gateway 2000 Nomad notebook PC can endure, just ask mountaineer Wally Berg. He took the Nomad 425DXL with him last fall on an expedition to the highest point on earth — the majestic, 29,128-foot Mount Everest in the Himalayan Mountains of Nepal.

Wally used the Nomad daily to track supplies, budget, and events of the climb. "Despite being transported over rugged terrain by yak, and operating in an unheated tent with temperatures outside of 20 to 30 degrees below zero, the Nomad performed flawlessly," said Wally. "The size was perfect, too. We had so many supplies to carry that size and weight were a big consideration."

Wally powered the Nomad with three sets of NiCad batteries which he recharged with a solar panel. Wally said the batteries weren't affected by the frigid temperatures. Each battery always lasted up to six hours.

The expedition left for its final climb to the Everest summit shortly after midnight on October 9. They ascended toward the peak by moonlight, reaching the top at 8 a.m. "It was a feeling of total exhilaration to finally reach the highest point in the world," said Wally.

Even if you don't plan to take your Nomad to Mount Everest, it makes the perfect traveling companion wherever you journey. The Nomad weighs just 5.6 pounds and measures 8.5 x 11 x 1.8 inches. Standard features include: a 25MHz Intel® 486SX or 486DX processor; 4MB RAM; an 80MB hard drive (425SXL model) or a 120MB hard drive (425DXL model); a 3.5-inch diskette drive; a 10-inch backlit VGA screen; a comfortable 79-key keyboard and FieldMouse™ portable pointing device; MS-DOS,® Windows™ and Works for Windows.™ Perhaps the most attractive feature is the price:

Nomad 425SXL ■ $1995 **Nomad 425DXL ■ $2695**

A Nomad gives you portability, 486 desktop performance, a great screen and keyboard, outstanding battery life — plus incredible durability. So take it from Wally Berg. If the Gateway Nomad can endure an Everest expedition, it can take almost anything!

GATEWAY2000

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Voice/Fax for Windows

You can use Ibex Technologies' FactsLine for Windows software for document-retrieval applications such as customer service, literature fulfillment, and forms distribution. The interactive voice/fax package offers fax-on-demand, fax-broadcasting, and voice-processing functions that you can configure and implement in the Windows environment.

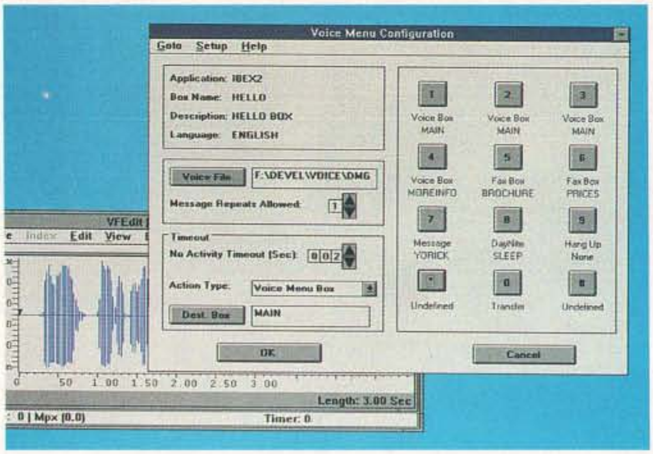
A pop-up scripting feature lets you compose and script the contents of voice announcements before you record them, and a simulation feature lets you test an application using the screen and mouse, instead of the telephone. The software also provides dated documents that automatically become inactive; on-line reconfiguration and updating of applications, voice announcements, and fax documents; a database-driven report generator; a visual voice editor; and document conversion tools.

FactsLine for Windows is also integrated with a voice-processing system to help direct calls through a multilevel voice-menuing system. This interactive voice response transfers callers to the appropriate mailboxes and permits them to leave messages after they have retrieved their requested documents.

Price: $6500.

Contact: Ibex Technologies, Inc., Placerville, CA, (916) 621-4342; fax (916) 621-2004.

Circle 1289 on Inquiry Card.



Application: IBEX2
Box Name: HELLO
Description: HELLO BOX
Language: ENGLISH
Voice File: F:\DEVEL\VOICE\DMG
Message Repeats Allowed: 1
Timeout
No Activity Timeout (Sec): 002
Action Type: Voice Menu Box
Dest. Box: MAIN

1 Voice Box MAIN
2 Voice Box MAIN
3 Voice Box MAIN
4 Voice Box MOREINFO
5 Fax Box BROCHURE
6 Fax Box PRICES
7 Message YORICK
8 Day/Nite SLEEP
9 Hang Up None
* Undefined
0 Transfer
# Undefined

Length: 3.00 Sec
0 | Mpx (0,0)
Timer: 0

Ibex Technologies' FactsLine for Windows can handle fax-broadcasting and fax-on-demand transactions simultaneously without degradation.

High-Speed Connectivity

Two high-speed connectivity products, the SunLink Frame Relay and the SunLink PPP, allow applications that you traditionally use on LANs, such as client-server databases, multimedia, the X Window System, and NFS (Network File System) applications, to run faster and more economically over global networks. You can also use both products with SunNet Manager to manage multivendor networks at local and remote sites.

The SunLink Frame Relay provides transparent IP connectivity to frame-relay networks over one or more links that can communicate at up to T1/CEPT speeds. You can have up to 1022 virtual point-to-point connections over each physical connection and obtain frame-relay virtual-circuit statistics.

The SunLink PPP allows communication at up to T1/E1 speeds between SPARC systems to extend beyond LANs to global networks. SPARC hosts can route TCP/IP traffic over point-to-point links by using the Internet PPP.

Price: $1150 each.

Contact: SunConnect, Mountain View, CA, (415) 960-1300; fax (415) 969-9131.

Circle 1287 on Inquiry Card.

EISA-to-SCSI Disk Array Controller

The Ultra 124F, an EISA-to-SCSI disk array controller, supports up to eight logical arrays, each of which can be virtually any capacity and any RAID level. The full-length card can support up to 35 SCSI-1, SCSI-2, and Fast SCSI-2 hard drives; provides complete data redundancy using RAID levels 0, 1, 4, and 5; and comes with UltraArray, a utility that lets you configure multiple arrays of mixed types and capacities.

The basic card comes with three Fast SCSI channels that you can expand via the optional 124FEX daughterboard, which adds two channels internally, or the optional 124FXT/3 and 124FXT/5 expansion boards, which add, respectively, three and five channels externally to the computer. The Ultra 124F supports DOS, Windows, NetWare, OS/2, and Unix operating environments.

Price: Ultra 124F, $1995; 124FEX, $375; 124FXT/3, $185; 124FXT/5, $425.

Contact: UltraStor Corp., Fremont, CA, (510) 623-8955; fax (510) 623-8953.

Circle 1285 on Inquiry Card.

PCMCIA Fax Modems

With OmniTel's Business Card 2496c and 2496c+ PCMCIA Type II fax modem cards, you can send and receive Group 3 faxes at 9600 bps from your portable computer. Both modems are identical except that the Business Card 2496c+ adds flash memory, MNP level 10, and support for the Cellular Phone Interface.

Features include automatic fallback from 9600 to 7200/4800/2400 bps and from 2400 to 1200/300 bps; 2400-/1200-/300-bps data transfer; MNP levels 2-4 and CCITT V.42 error correction; and MNP level 5 and CCITT V.42bis data compression.

Price: Business Card 2496c with DOS software, $349; with Windows software, $375; Business Card 2496c+ with DOS software, $399; with Windows software, $425.

Contact: OmniTel, Inc., Fremont, CA, (510) 490-2202; fax (510) 490-1285.

Circle 1286 on Inquiry Card.

Micro Fiber Optic Transceiver

A compact adapter, the Transcast ENT-4322 Micro Fiber Optic Transceiver provides direct connection of Ethernet-based computers, servers, workstations, and peripherals to fiber-optic, 10Base-FL/FOIRL networks. The ENT-4322 features six diagnostic LEDs that indicate Jabber, Link, Collision, receive data, transmit data, and power, as well as a user-selectable Signal Quality Error switch.

Price: $325.

Contact: Lancast, Amherst, NH, (800) 752-2768 or (603) 880-1833; fax (603) 881-9888.

Circle 1288 on Inquiry Card.

PC MAGAZINE
EDITORS' CHOICE
COLORADO MEMORY SYSTEMS JUMBO 250 EXTERNAL
Colorado Memory Systems, Inc.
April 14, 1992

Thirteen reviewed. One winner.

IN REVIEW AFTER REVIEW, Jumbo takes top honors. PC Magazine's *exclusive* Editors' Choice is the 12th award in the last year. Which proves Jumbo is a backup value that can't be beat. Jumbo gives you top performance, yet it's easy to use. Choose either Jumbo 120 (120 MB with data compression) or Jumbo 250 (250 MB with data compression). Both give you QIC compatibility, Novell® Certification and UNIX®/Xenix® support. Call 1-800-451-0897, ext. 163 today for a free brochure.

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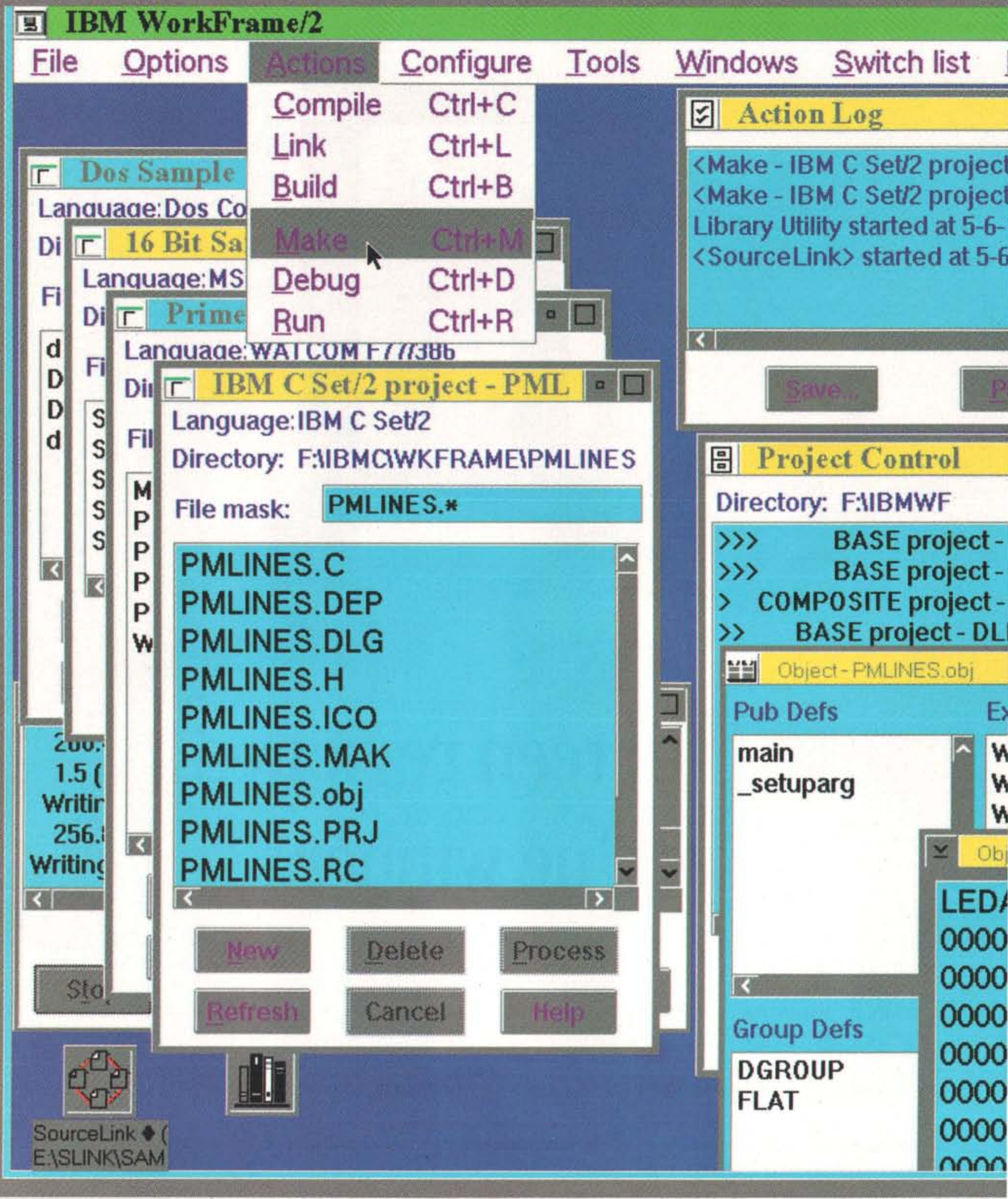
Circle 68 on Inquiry Card (RESELLERS: 69).



Action Log

```
<Make - IBM C Set/2 project
<Make - IBM C Set/2 project
Library Utility started at 5-6-
<SourceLink> started at 5-6
```

IBM C Set/2 project - PML

Language: IBM C Set/2

Directory: F:\IBMC\WKFRAME\PMLINES

File mask: PMLINES.*

```
PMLINES.C
PMLINES.DEP
PMLINES.DLG
PMLINES.H
PMLINES.ICO
PMLINES.MAK
PMLINES.obj
PMLINES.PRJ
PMLINES.RC
```

Language: Dos Co

Language: MS

Language: WATCOM F77/386

Project Control

Directory: F:\IBMWF

```
>>>     BASE project -
>>>     BASE project -
>  COMPOSITE project -
>>     BASE project - DL
```

Object - PMLINES.obj

Pub Defs

```
main
_setuparg
```

Group Defs

```
DGROUP
FLAT
```

OS/2

*In Canada: call 1 800 465-7999. HelpWare limited to U.S.A. only. IBM and OS/2 are registered trademarks and OS/2 Crash Protection and HelpWare are trademarks of International Business Machines Corporation. Windows is a trademark of Microsoft Corporation. CompuServe is a registered trademark of CompuServe, Inc. © 1992 IBM Corp.

```
ES> started at 5-6-1992 19:48
ES> ended tc = 0 rc = 0 at 5-6-1992
2
42
```

```
til 1
til 2
```

```
e          CODE32 DWORD USE32 P
MsgQue     DATA32 DWORD USE32 P
erClass    CONST32 DWORD USE32 
t - CONST32 DWORD USE32 PUBLIC 'CONST'
FFSET 0 LENGTH 8f
D795F57 696E646F 77000000 4
3204D6F 75736520 42757474 6F
0746F20 4368616E 67652046 6F
26F756             6F722C 2
365204  7574746F 6E 03220 74
C65617  2E202044 6  75626C 6
```

To a software developer, this is what heaven looks like.

Most people wouldn't know what to make of a screen like this. But developers like you know a screen like this can help make all kinds of applications. With OS/2® 2.0, you can develop the DOS, Windows,™ OS/2 and host-based apps end users need. And you can do it faster and easier than ever before. Because OS/2 2.0 can make the most of your 386 or 486 processor.

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- *The integrating platform of choice for DOS, Windows and OS/2.*
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Circle 89 on Inquiry Card.

IBM®

GUI Tools for X Developers

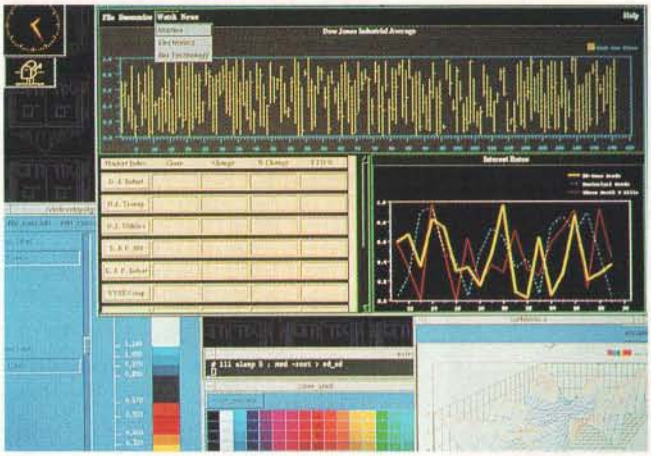
With DynaGraphX, you can build Motif GUIs containing real-time graphs, meters, and dials, and generate all the Motif C code you need to implement your interface. The DynaGraphX package includes X-Designer, the DataViews Graph Widgets, the Color Threshold Table Editor, convenience functions, and sample programs.

A Motif GUI builder, X-Designer includes a layout editor, a WYSIWYG design window, and a widget selection palette. DataViews Graph Widgets contains 40 real-time graphs, meters, and dials; the Color Threshold Table Editor lets you tie color thresholds to your graphs; and the convenience functions simplify resource setting and object creation.
Price: DynaGraphX development license, $7000.
Contact: V.I. Corp., Northampton, MA, (413) 586-4144; fax (413) 586-3805.
Circle 1294 on Inquiry Card.

CASE for Windows

A CASE tool set for Windows, Visible Analyst Workbench 5.0 provides an integrated forward- and reverse-engineering environment that helps you through the planning, design, and analysis of the application development process. The package helps you generate SQL database schemata, COBOL source code, and C source code from designs you have developed in the system.

Visible Analyst Workbench includes multipage document support, model navigation improvements, control-bar support, repository data access, and text-editing enhancements. It also contains Windows features such as pop-up and pull-down menus, Clipboard-based data exchange with external applications, and support for Windows-compatible device drivers, color sets, and fonts.
Price: $1895 and up.
Contact: Visible Systems Corp., Waltham, MA, (617) 890-2273; fax (617) 890-8909.
Circle 1295 on Inquiry Card.



You can build a sample stock-watch window with the X-Designer, DataViews Graph Widgets, and Color Threshold Table Editor components of V.I.'s DynaGraphX.

Pen Application Builder

You can use the PenApps Application Builder 1.0 to create forms-based and data-intensive applications for pen-based computers. The package, which runs on Windows for Pen Computing and PenPoint, includes a screen/forms designer, a built-in database, and the Slate PenBasic programming language. You can build into your applications pencentric features such as ink as a data type, input targeting, markup mode, switch to ink, deferred translation, gesture support, cursorless operation, coerced translation, and sketch fields.

With the PenApps Application Builder, application components are identical for both operating systems. You can move compiled PenApps applications from one platform to another yet still take advantage of operating-system-specific capabilities such as DDE under Windows for Pen Computing and Embedded Document Architecture under PenPoint.
Price: $995.
Contact: Slate Corp., Scottsdale, AZ, (602) 443-7322; fax (602) 443-7325.
Circle 1296 on Inquiry Card.

C++ and OOP

CenterLine Software has added precompilation of header files, demand-driven generation of program information, and support for C++ templates to ObjectCenter 2.0, the latest version of its Unix C++ programming environment. Version 2.0 also offers a C++ interpreter and integrated run-time error detection that let you reuse code and use, understand, and develop C++ class libraries.

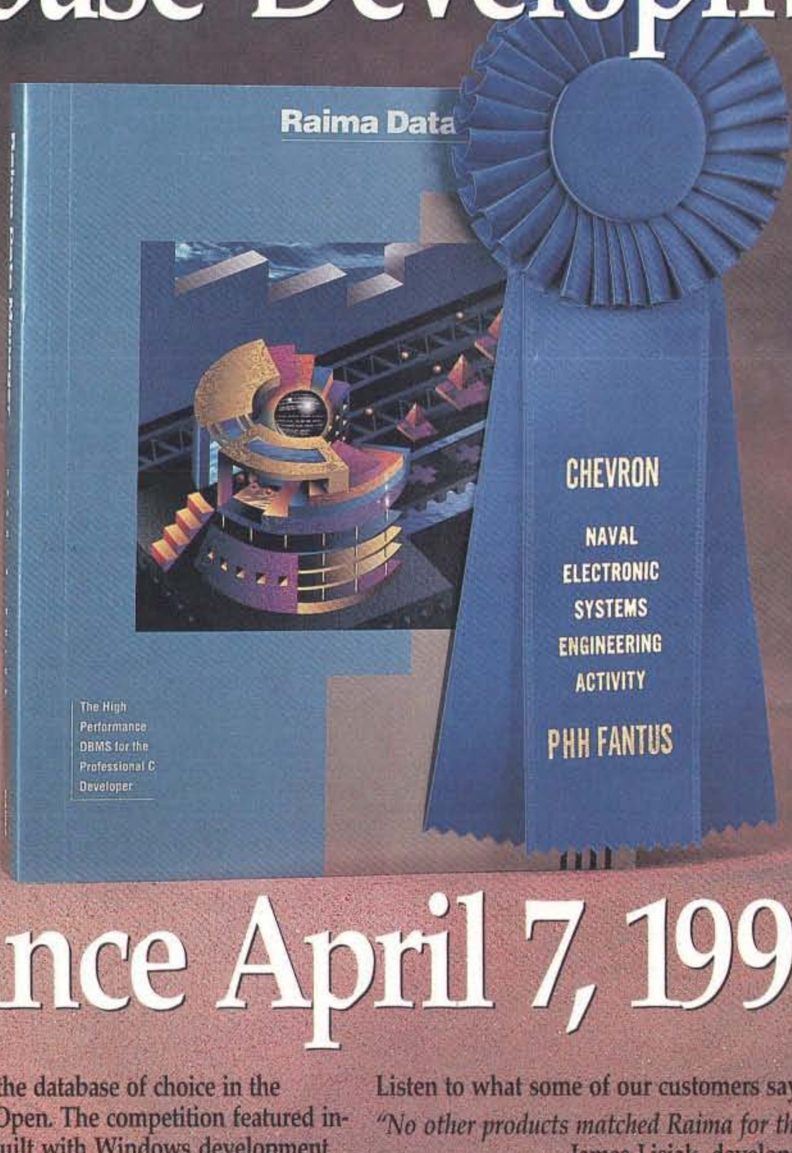
The package supports C++ templates, including the browser, debugger, and interactive workspace. It also includes enhanced debugging, fast object-code run-time error checking, advanced dynamic-code and data-visualization capabilities, and support for OpenLook and Motif. In addition, ObjectCenter 2.0 includes the C development capabilities found in CodeCenter, CenterLine's Unix C programming environment, providing a C and C++ mixed-language development capability.
Price: $3995.
Contact: CenterLine Software, Inc., Cambridge, MA, (617) 498-3000; fax (617) 868-6655.
Circle 1297 on Inquiry Card.

CASE for Clipper

Designed for application development in Clipper, the dBsee (for database software engineering environment) package helps you automate and optimize the software development cycle. The modular system includes tools that guide you through definition of the data dictionary and application dictionary, prototyping and simulation, generation of source code and the database, compilation and linkage, documentation, and maintenance support.

The dB-Lan tool provides functions and templates for generating LAN-based applications. The dB-Doc tool generates the technical reference and user's manual, and the dB-Show tool generates tutorials and demonstrations of your application.
Price: About $3549 (4,791,150 lira).
Contact: Italian Software Agency s.r.l., Baveno, Italy, +39 323 92 20 66; fax +39 323 92 52 08.
Circle 1298 on Inquiry Card.

Since when is Raima first in Corporate Database Development?


Raima Data
The High Performance DBMS for the Professional C Developer
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NAVAL ELECTRONIC SYSTEMS ENGINEERING ACTIVITY
PHH FANTUS

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Raima Database Manager was the database of choice in the First Annual Windows World Open. The competition featured innovative custom applications built with Windows development tools. Three of the seven winners, and two of the finalists, used *Raima Database Manager* to solve their critical application needs.

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- *Affordable pricing:* starting at just $395.
- *Language support:* ANSI C, C++, and Visual Basic.

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"No other products matched Raima for the price."
James Lisiak, developer, Chevron

"Raima provided us with speed, flexibility, and royalty-free distribution which allowed us to meet and exceed our customers' needs."
Dave Cooper, developer, Atlantic Research Corp,
(subcontractor, Naval Electronic Systems Engineering Activity)

"Database Manager gave us the edge we needed to handle large amounts of data quickly and efficiently within Microsoft Windows..."
Kelly Patrick, developer, PHH Fantus

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Circle 127 on Inquiry Card

Payroll Software for the PC

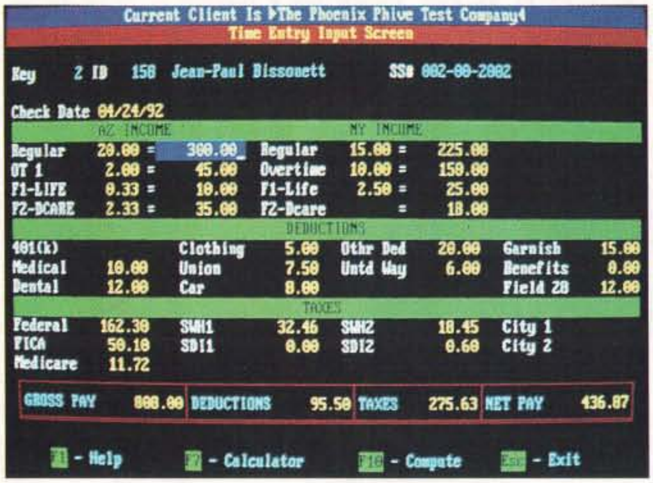
Version 2.0 of Industrial Strength Payroll automates weekly, biweekly, semimonthly, and monthly payrolls for up to 30,000 employees, who can be hourly, salaried, or 1099 personnel. The software can handle up to 999 companies and mixed payroll frequencies.

Multistate capabilities help companies that operate in more than one state to consolidate reporting. The multistate feature can also accommodate employees who are subject to taxes from more than one state. Industrial Strength Payroll can also process dependent care, excess group term life insurance, automobile insurance, and fringe benefits.

Price: $245.

Contact: Phoenix Phive Software Corp., Scottsdale, AZ, (800) 331-1811 or (602) 483-0991; fax (602) 948-1379.

Circle 1299 on Inquiry Card.



```
           Current Client Is ▶The Phoenix Phive Test Company◀
                        Time Entry Input Screen

Key     2 ID   158  Jean-Paul Bissonett          SS# 002-00-2002

Check Date 04/24/92
            AZ INCOME                      NY INCOME
Regular   20.00 =    300.00_ Regular   15.00 =   225.00
OT 1       2.00 =     45.00  Overtime  10.00 =   150.00
F1-LIFE    0.33 =     10.00  F1-Life    2.50 =    25.00
F2-DCARE   2.33 =     35.00  F2-Dcare        =    18.00
                              DEDUCTIONS
401(k)             Clothing     5.00  Othr Ded    20.00  Garnish    15.00
Medical    10.00   Union        7.50  Untd Way     6.00  Benefits    0.00
Dental     12.00   Car          8.00                     Field 20   12.00
                                TAXES
Federal   162.30   SWH1        32.46  SWH2        10.45  City 1
FICA       50.10   SDI1         0.00  SDI2         0.60  City 2
Medicare   11.72

 GROSS PAY    808.00 DEDUCTIONS     95.50 TAXES    275.63 NET PAY    436.87

     F1 - Help        F2 - Calculator       F10 - Compute      Esc - Exit
```

Phoenix Phive's Industrial Strength Payroll accepts time in increments of hours and minutes, and it lets you import time-clock information in ASCII format.

Resource Planning

A Unix-based enterprise resource planning system for process manufacturers, ManBase 7.0 combines a client/server architecture, a relational database management system, and fourth-generation-language tool sets. The package includes inventory and production management, sales order management, and full financial capabilities. In addition, you can integrate ManBase with third-party floor-control management systems, electronic data interchange partners, CASE/CIM/CAD tools, and legacy systems.

The modular package lets you build and maintain components and their characteristics for a formula or recipe. With the Master Production Scheduling module, you can view actual and forecasted product demands and determine the dates, times, and quantities for planned orders.

Price: $60,000 and up, depending on configuration, number of modules, and number of users.

Contact: MAI Systems Corp., Novi, MI, (313) 347-9070; fax (313) 347-8958.

Circle 1300 on Inquiry Card.

TimeVision for Mac

The Mac version of the TimeVision personal information management tool gives you 24-hour scheduling at any level of detail with daily, weekly, and monthly windows. You can create multiday events and reliable repeating events over a specified time range.

The PowerEdit feature lets you describe events in an annotation box; designate the begin and end dates, the begin and end times, the type of event, and the frequency; and then set a reminder. With TimeVision's Memo feature, you can create, read, and save ASCII text files; open and read text files you have created in another application; and create a Memo Folder containing business-letter templates or notes from phone conversations. The Note Card file lets you create, sort, browse, and edit an address book, a phone list, or a product catalog.

Price: $99.

Contact: Powercore, Inc., Manteno, IL, (800) 237-4754 or (815) 468-3737; fax (815) 468-3867.

Circle 1301 on Inquiry Card.

PrismaOffice for Windows

PrismaOffice for Windows combines document processing with a database, links to external databases, and E-mail facilities. It includes a 180,000-word spelling checker and a 240,000-entry thesaurus. PrismaOffice for Windows accepts Prisma Language Modules, which let you switch the user interface among major European languages.

The software supports Microsoft's Multiple Document Interface, which lets you open up to nine documents simultaneously. Support for Microsoft's OLE and DDE capabilities lets you link information from other files into PrismaOffice for Windows documents. The software automatically updates documents when you change an original file or file segment.

Price: Stand-alone version, about $600 (£395); three-user network version, about $1360 (£895); each additional user, about $266 (£175).

Contact: Prisma Office, Ltd., Slough, Berkshire, U.K., +44 753 810899; fax +44 753 810903.

Circle 1302 on Inquiry Card.

Successful Negotiations

Negotiator Pro prepares you for all types of negotiations. The package (for the Mac, DOS, Windows, and OS/2) provides a logical and structured way to explore options, reconcile competing interests, and creatively brainstorm.

Negotiator Pro consists of three interactive parts: the Plan, the Hypertext, and the Profile. You use the Plan to tailor question-and-answer structures to your needs. The Hypertext section contains more than 350 terms, 15 international negotiation styles, 50 tactics, legal and business ethics, traditional and cutting-edge theory, and important figures in negotiation. The Profile section asks 11 questions about both sides in a dispute. It then analyzes the parties' negotiation and personality types, predicts the dynamics of the exchange, and advises you on how to approach each side.

Price: $499 to $648.

Contact: Beacon Expert Systems, Inc., Brookline, MA, (617) 738-9300; fax (617) 734-3308.

Circle 1303 on Inquiry Card.

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STANDARD UNITS

These UL/CSA approved, fully-tested power supplies are the best basic units available.

STANDARD 200 XT	**$69**
STANDARD 205 SLIM	**$89**
STANDARD 220 BABY	**$89**
STANDARD 220 AT/TOWER	**$89**

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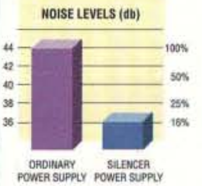

Unrattle your nerves with a Silencer power supply, recognized since 1986 as the industry's quietest. Cooled with efficient, variable-speed fans that are virtually inaudible! A must for home office or multimedia applications.

SILENCER 205 SLIM	**$119**
SILENCER 220 AT/TOWER	**$129**
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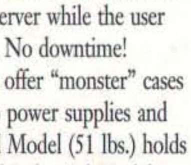
TURBO-COOL 200 XT	**$159**
TURBO-COOL 300 SLIM	**$169**
TURBO-COOL 300 BABY	**$169**
TURBO-COOL 300 AT/TOWER.	**$189**
TURBO-COOL 450 AT/TOWER.	**$349**

REDUNDANT POWER SYSTEM

Eliminate the risk of costly downtime or data loss due to power supply failure with the TwinPower 900 Redundant Power System. The system consists of two Turbo-Cool 450 power supplies in parallel, utilizing a special power-management interface module. You'll have the reliability of complete power redundancy for the entire network server.

- **Super Server Power.** With 900 watts of peak power, the TwinPower 900 effortlessly runs any array of drives-- without the need for sequencing.
- **100 Times More Reliable.** Why gamble with a single-unit system? TwinPower's load-sharing, redundant design lets you take the power system for granted. It's the peace-of-mind a network manager needs!

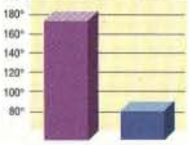


- **Hot-Swap Capability.** In the unlikely event that one of its 450s should fail, an alarm sounds, and the other 450 sustains the server while the user simply swaps in a new unit. No downtime!
- **Optional Enclosures.** We offer "monster" cases that hold TwinPower's two power supplies and the interface. The Standard Model (51 lbs.) holds 13 drives, while the all-steel Industrial Model (104 lbs.) allows dual systemboards and holds up to 16 drives. Now, that's expandability!

TWIN-POWER 900	**$995**
W/STANDARD CASE	**$1695**
W/INDUSTRIAL CASE	**$1995**

486 CPU COOLER

It's a fact that 486 chips run hot, often exceeding 185°F! Now, you can reduce the temperature of your 486 processor to a cool, safe 85° - 95°F with our CPU-Cool. You'll prevent random system errors and add years to the life of your valuable CPU. Consists of an ultra-quiet mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!



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Protect your PC and its data from power surges, sags, and outages with our UL-approved InnerSource, a combined AT/Tower power supply and On-Line UPS. Its auto-recharge battery provides up to 15 minutes of backup power for both your PC and monitor. This reliable, integrated protection costs less than an equivalent 550VA external UPS, and it saves space too! A Novell interface is available.

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Circle 115 on Inquiry Card (RESELLERS: 116).

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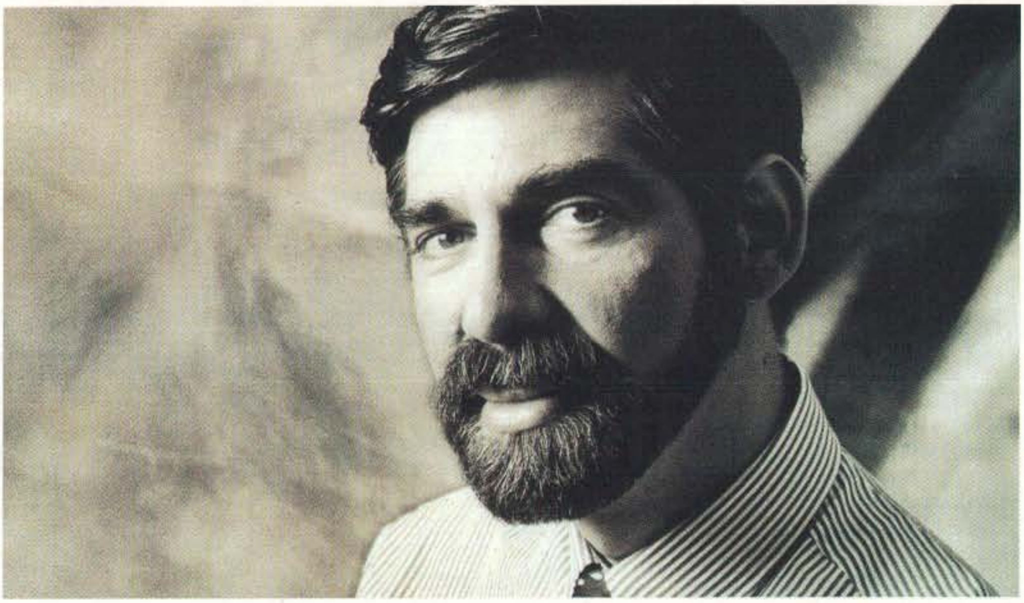
POPKIN SOFTWARE & SYSTEMS, INC.



"I'm an engineer. And I know what it's like to need a high-performance and easy-to-use CASE tool. One that I could afford to place on every project team member's desk, not just a select few. That's why I developed System Architect™.

As Chief Scientist at Popkin Software, my role is to bring the real-world experiences of our developers to bear on the design and implementation of the best CASE tool possible. System Architect is the result.

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Since its introduction in 1988, System Architect (SA) has proven that many of the features offered by more expensive CASE tools are available for a fraction of the cost. There are now more than 10,000 SA copies in use at 2,500 installations worldwide.

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System Architect works on IBM® and IBM-compatible PCs running *MS Windows® and OS/2 PM®*. It comes with an integrated data dictionary that users can customize to meet their needs. Project personnel can easily share information both on and off a network. It's so user-friendly that even from the first day you can sit down, get to work, and produce results.

▼Generate schema from entity diagrams.

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System Architect works with multiple methodologies: Yourdon/DeMarco, Gane & Sarson, Ward & Mellor (real-time), Booch, Shlaer/Mellor (OO), Coad/Yourdon, Information Engineering and SSADM. And diagram types and charts including: DFDs, Entity Relation diagrams, Decomposition diagrams, State Transition diagrams, Structure Charts, and Flow Charts.

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To respond to advances in technology such as Client/Server Architecture, SA continues to grow in functionality and productivity. A few optional modules now offered are:

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SA Network Version: Diagram and data dictionary record locking allows multiple project members to work concurrently on the same project.

Built for Engineers.

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Create Presentations

With Passport Producer and your Mac, you can easily integrate and synchronize animation, digital video, sound, music, and presentation graphics. This multimedia presentation-software package lets you add sound tracks to QuickTime movies and animations and accurately synchronize to MIDI or digital audio using the Cue Sheet feature.

The Cue Sheet displays all tracks and time locations, so you can see the events or cues in a visual form as they relate to each other in time. You can align multiple cues for simultaneous playback and print out the Cue Sheet to use in a paper edit, to review with clients, or to aid in storyboarding. Passport Producer lets you import cues in TEXT, PICT, PICS, or QuickTime file formats.

Passport Producer displays the final presentation on a user-customized stage. You can position visual elements and arrange multiple objects on the stage in an unlimited number of ways. The package also lets you display presentations on two or more monitors simultaneously.

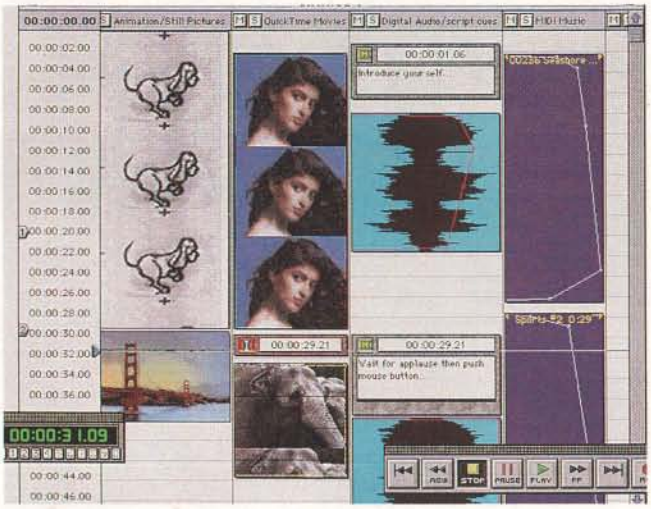
Price: $495.

Contact: Passport Designs, Inc., Half Moon Bay, CA, (415) 726-0280; fax (415) 726-2254.

Circle 1305 on Inquiry Card.

Sound and Music for Windows

The AudioView package contains three applications for Windows that let you control the digital-audio and CD-ROM functions of PC sound cards and multimedia PCs. The applications are AudioView, the Voyetra Audio Mixer for Windows 3.0, and the Voyetra CD Player.



Passport Producer, a control center for multimedia productions, links to popular authoring and editing software that imports standard Mac file types.

The AudioView digital-audio editor records, edits, and plays music, narration, or sound effects as digital-audio files stored on your computer's hard drive. The file display window gives you a graphical view of the entire file or lets you zoom in for a closer look—as close as a single sample.

With the Voyetra Audio Mixer, you can control the volume levels of most types of sound. You can preset levels before recording or playing, or mix them during operation for perfectly balanced sound tracks.

The Voyetra CD Player helps you name and catalog disks to facilitate locating and playing a CD track. The Playlist feature lets you assemble and play a series of CD audio tracks in any order. Or, you can let the CD Player's Shuffle feature play tracks in random order.

Price: $129.95.

Contact: Voyetra Technologies, Pelham, NY, (914) 738-4500; fax (914) 738-6946.

Circle 1308 on Inquiry Card.

Movie Clips on CD-ROM

The Action CD-ROM comes with clips for QuickTime for Windows, complete with Apple Computer's Movie Player for Windows, QuickTime DLLs, and Windows Picture Viewer. You can play Action's four categories of movie clips from the CD-ROM or copy them to your hard drive.

Movie categories include historical, modern, music video, and sound-only movies. Also included are 3-minute segments of MTV-style music videos. The Action CD-ROM also contains high-quality pictures that you can display, zoom, and scroll using the Picture Viewer.

Price: $89.95.

Contact: The San Francisco Canyon Co., Inc., San Francisco, CA, (415) 398-9957; fax (415) 398-5998.

Circle 1306 on Inquiry Card.

Entry-Level Multimedia

Now nontechnical users can enter the world of multimedia with UCM's MM Box 2 multimedia production software package. The package lets you bring together analog and digital video, graphics, images, 2-D and 3-D animation, and stereo sound.

Two versions of MM Box 2 are available: a 3½-inch floppy disk version and a CD-ROM version. The CD-ROM version includes 125 animations; an Image Photo Library containing 250 BMP digitized images and 750 thumbnail images; 25 minutes of original music; 45 sound effects; and MM Browser software, which lets you search through the elements.

Price: Floppy-disk version, about $190 (£125); CD-ROM version, $454 (£299).

Contact: UCM, Ltd., Hove, East Sussex, U.K., +44 273 208103; fax +44 273 774064.

Circle 1307 on Inquiry Card.

Sound-Editing Software

Digital Soup Sound Professional lets you edit and mix as many as 16 tracks of imported sound files or sounds recorded from a CD-ROM, microphone, or other player device that can interface with your sound board. The editor offers functions such as cut, paste, copy, and delete, and imports and exports standard Windows audio files. It is an OLE server.

You can choose various sound effects, including fade-in, fade-out, modulate, compress, reverse, repeat, and delay. You can also view and modify the frequency content of your sound with Digital Soup's 3D Spectral Analysis and its four-band parametric equalizer.

Price: $99.

Contact: Digital Soup, Inc., Brattleboro, VT, (802) 254-7356; fax (802) 254-6812.

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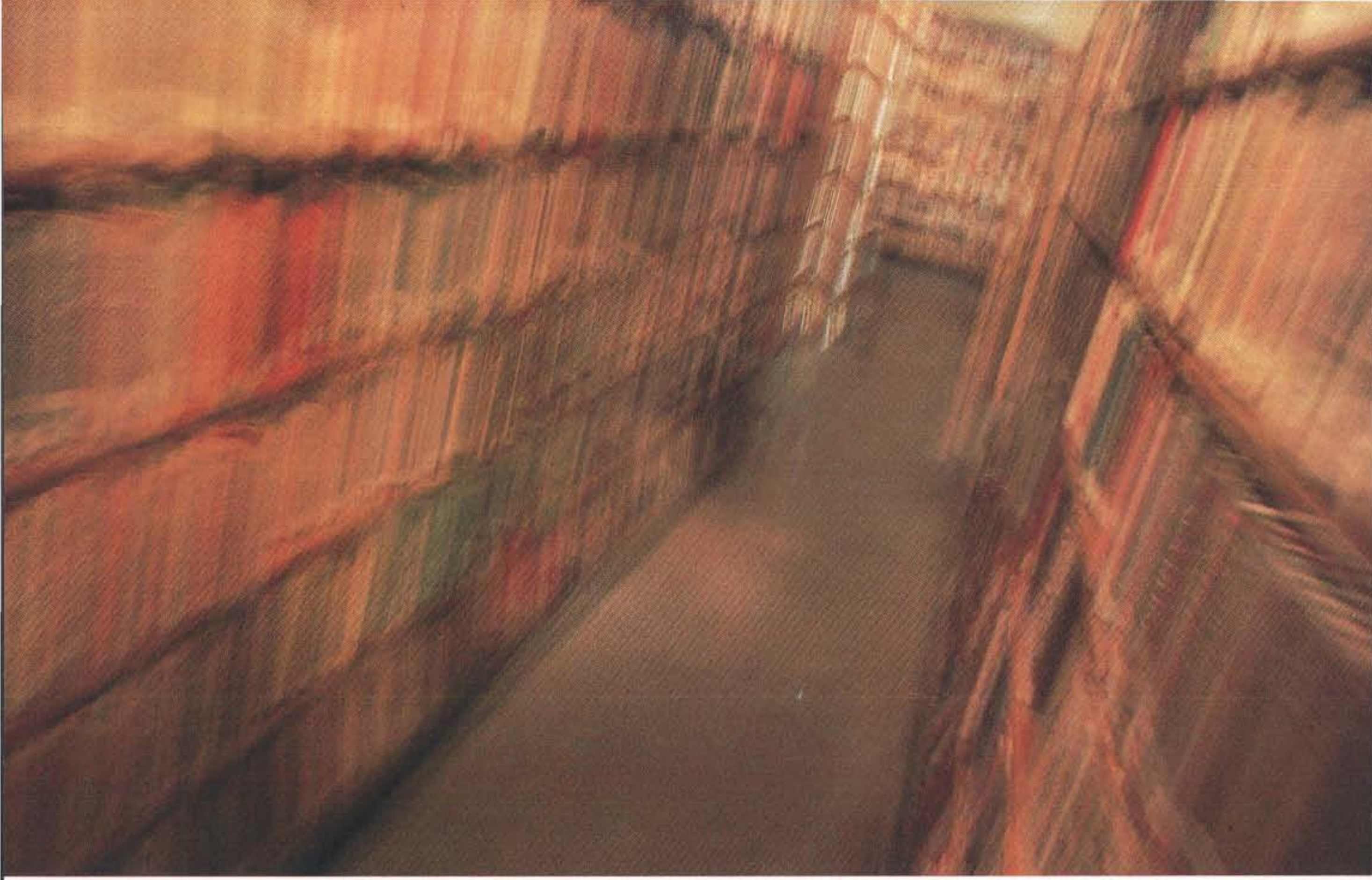

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Geometry Solver for Pen PCs

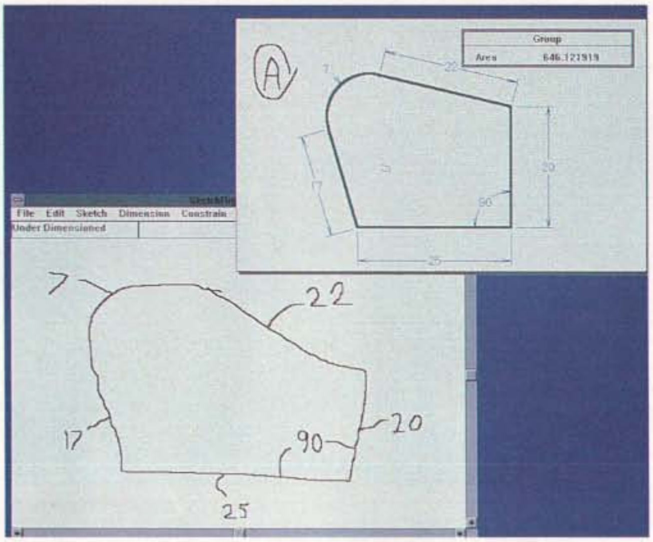
Now you can use your pen-based computer as a geometry collection station with Saltire Software's SketchRight. You sketch in the geometry and enter the distances or angles you want to measure. SketchRight gives you an accurate to-scale representation and then calculates unknown distances, angles, and areas measured from the scale drawing.

SketchRight also includes two-way .DXF links, which let you communicate with most standard CAD packages, and two-way DDE communication and Clipboard support, which lets you communicate with other Windows for Pens applications.
Price: $249.
Contact: Saltire Software, Inc., Beaverton, OR, (503) 622-4055; fax (503) 622-4537.
Circle 1310 on Inquiry Card.

Windows File Utility

Systems Compatibility has added to Outside In 2.0 for Windows support for graphics and compressed files, file management, and the ability to integrate the software into Windows E-mail programs to view attachments. You can use the file-viewing and data-import utility with E-mail programs, word processors, and BBS files, or anytime you need to look at a file.

The package lets you view files from more than 90 DOS, Windows, and Mac formats; launch applications from a file view; copy data to the Clipboard for use in other Windows programs; combine data from word processors, spreadsheets, and databases; and search across directories, drives, and networks by filename, file type, file extension, or text string. The Tear-Off feature lets you view multiple files at one time, and the Text Search feature lets you search a document or file list for specific words or phrases.



SketchRight by Saltire Software combines a sketch-based drawing package with an embedded Constructive Variational Geometry engine to create a two-way link between the geometry and a mathematical equation solver.

Outside In recognizes and displays more than 120 file types from DOS, Windows, Mac, DEC, and Wang programs and lets you paste graphics, text, spreadsheet, or database files from DOS, Windows, and Mac programs into the mail edit window. It also integrates directly with cc:Mail, Microsoft Mail, WordPerfect Office, and Da Vinci eMail.
Price: $89.
Contact: Systems Compatibility Corp., Chicago, IL, (800) 333-1395 or (312) 329-0700; fax (312) 670-0820.
Circle 1311 on Inquiry Card.

Turn Your Mac into a Dictaphone

With the Useful Voice Processor, you can turn your sound-capable Mac into a fully functional dictation machine. In environments where typing or mousing is not appropriate, this software-only product lets you dictate a letter, compress it, and store it on disk with one-finger operation.

The package uses Apple's MACE (Macintosh Audio Compression and Expansion) technology to compress the sound as you record it, and a proprietary silence elimination algorithm automatically cuts out the pauses when you speak. A transcription function lets you type text while the program is playing back the recorded sound. The Useful Voice Processor stores the transcription in a separate document from the audio, and it is fully compatible with most word processors.
Price: $179.95.
Contact: Useful Software Corp., Beverly Farms, MA, (508) 922-7272; fax (508) 922-0413.
Circle 1312 on Inquiry Card.

SPREAD THE WORD

Please address new product information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please include a product description, price, ship date, and an address and telephone number.

Protect Your Unix System

Woodside Technologies' Fortress package is a GUI-based security program with antivirus protection for Unix. Using a point-and-click interface, the program provides Unix users and system administrators with four security modules that run from a central menu. The security modules include the Trojan Horse Detector, the Worm-Proofer, the File Inoculator, and the Password Cracker.

The Trojan Horse Detector searches the user's path, the entire system, or any system portion you specify to locate duplicate copies of common Unix commands. The Worm-Proofer detects and eliminates weak-security entry points that might allow unwanted programs to log onto a remote system through network connections and replicate themselves.

The File Inoculator searches files and adds a unique fingerprint in an encrypted format without changing the files. The fingerprints are stored in a secure database, which automatically scans files at user-specified time intervals. The Password Cracker module attempts to crack all passwords to ensure that those that are easy to guess do not threaten the security of the system.
Price: $495.
Contact: Woodside Technologies, Inc., Sunnyvale, CA, (408) 733-9503; fax (408) 732-7335.
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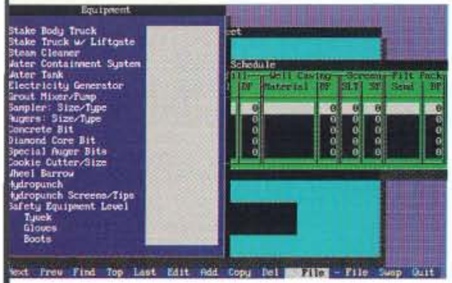
Equipment
Schedule
ill Well Casing Screen Filt Pack
DP Material DP SLT DP Sand DP
ext Prev Find Top Last Edit Add Copy Del File - File Swap Quit

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Stake Body Truck
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   Tyvek
   Gloves
   Boots
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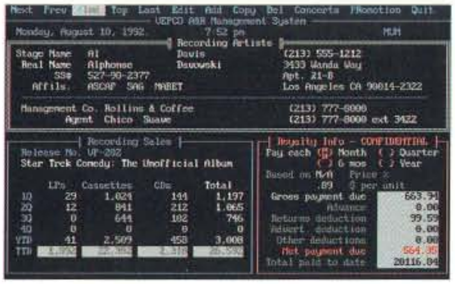
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Monday, August 10, 1992          7:52 pm                    MUM
Stage Name   Al          Davis          (213) 555-1212
 Real Name   Alphonse    Davowski       3433 Wanda Way
       SS#   527-90-2377                Apt. 21-B
   Affils.   ASCAP  SAG  MABET          Los Angeles CA 90014-2322

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Star Trek Comedy: The Unofficial Album         ( ) 6 mos  ( ) Year
                                      Based on M/A   Price x
      LPs  Cassettes   CDs   Total                .89  $ per unit
1Q     29    1,024     144   1,197    Gross payment due      663.91
2Q     12      841     212   1,065               Advance       0.00
3Q      0      644     102     746     Returns deduction      99.59
4Q      0        0       0       0     Advert. deduction       0.00
YTD    41    2,509     458   3,008      Other deductions       0.00
TTD                                      Net payment due      564.35
                                      Total paid to date   20116.04
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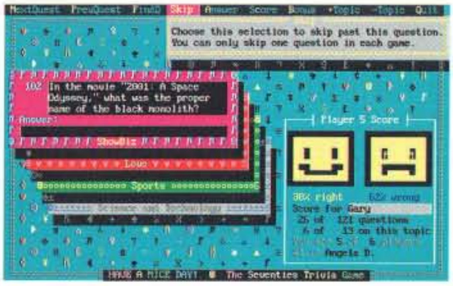
Want to make a slick-looking system to track recording artists, sales and royalty payments? With DataBoss, you can.

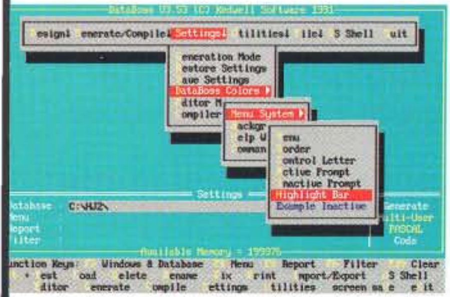

NextQuest PrevQuest FindQ Skip Answer Score Bonus +Topic -Topic Quit
ShowBiz
Love
Sports
Science and Technology
Player 5 Score
HAVE A NICE DAY! The Seventies Trivia Game

```
Choose this selection to skip past this question.
You can only skip one question in each game.

102  In the movie "2001: A Space
     Odyssey," what was the proper
     name of the black monolith?
Answer:

38% right      62% wrong
Score for Gary
 25 of   121 questions
  6 of    13 on this topic
         5         6
      Angela D.
```

Can you customize how your applications work and look, like this wild game? With DataBoss, you can. Note the online help.


DataBoss V3.53 (C) Kedwell Software 1991
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atabase C:\HJ2\
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PASCAL
Code
Available Memory = 199976
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ditor enerate ompile ettings tilities screen sa e e it

DataBoss was even used to build itself!

Want to build C or Pascal database applications *in minutes*?

With DataBoss, you can.

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As one of our users reported last week, I just finished a project with DataBoss in day and a half. Before DataBoss, it vould have taken me a month."

Developer Stephen Moore writes, "Data-Boss has saved my company hundreds of ours of programming time and thouands of dollars."

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ataBoss builds systems for you

DataBoss generates *all parts* of your pplication: menus, files (with file linkng), data entry screens, reports, utilities.

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Byte reports, "The applications generted are very sophisticated, with all the sual features, including full field editing, field default and validation checking, user-defined queries, automatic index maintenance, customization capabilities and user-defined error messages."

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DataBoss writes programs in *customizable Pascal or C*. Then, with your compiler, it creates executable applications. You get customizable source code to the libraries and files that DataBoss uses to generate your programs. So you can change the libraries, or use your own.

If you're a veteran programmer or a novice, DataBoss lets you *choose* your level of involvement with source code. You're supported by DataBoss menus, online help, and our friendly support staff.

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DataBoss builds both single-user and *networked* systems. Just choose "Multi-User;" DataBoss adds record locking and other network functions. It's that simple.

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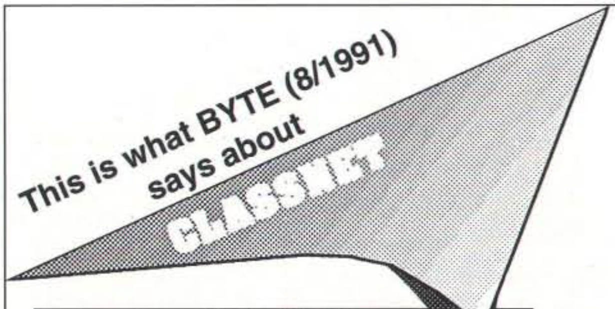
This is what BYTE (8/1991) says about
CLASSNET

NEWS
WHAT'S NEW INTERNATIONAL

"Computerized Classroom

Classnet from Minicom Advanced Systems is a dedicated communication network that gives instructors control over all activities, by all students, in the classroom.

...The Electronic Blackboard function lets you see a student's screen, display your own screen to any or all students, display a student's screen to the entire class, and send messages in real time to any or all students. The Interject function lets you disconnect the keyboard and darken the students' screens, giving you command over classroom activities.

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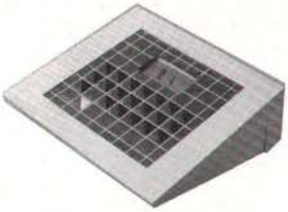
The Print function lets you control one printer from the teacher's unit, while the Help function tells you that a student needs help, showing you the student's station number on your screen..."

CLASSNET - The unique communication network, giving instructors control over all activities, by all students in the classroom.



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Hannover-Germany
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dBsee 3.0

See us at RomaUfficio '93
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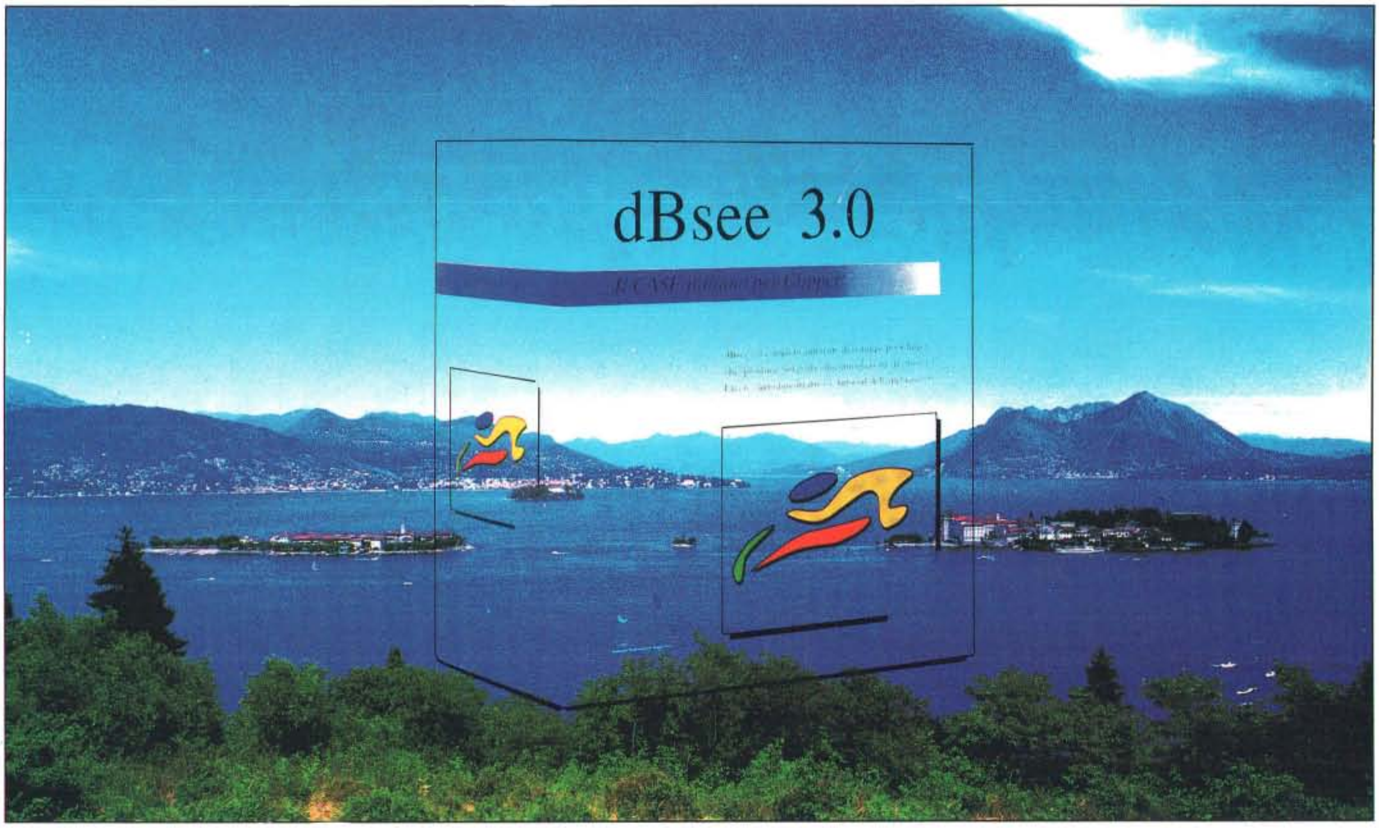

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he highly modular structure of the whole evelopment environmental and of the geerated sources makes it possible for the rogrammer to manually enter source code locks in many points of the automatically generated sources. The modifications are identified, saved and restored in successive automatic generations using **Reverse Engineering** techniques.

Technical features
The design of the data entry forms allows one to use:

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say - get - functions - expressions - memo fields - semi graphic fonts - boxes etc. - conditional display and edit - multi-level look-up windows on every encoded field with data-entry facility for data not present in file - selective refresh of screen fields - virtual screen for data entry management of formats of up to 65,000 lines by 65,000 columns - windows with horizontal and vertical scroll - printer/screen/color configuration. The generated applications feature **Contextual Help** and windows which facilitate the search on encoded information.
Reports. Unlimited number of scanned files - up to 9 grouping levels plus general total. Print attributes for every item (-bold, underline, italic, etc) - Summarising computations (min, max, total, mean, variance, standard deviation, range).
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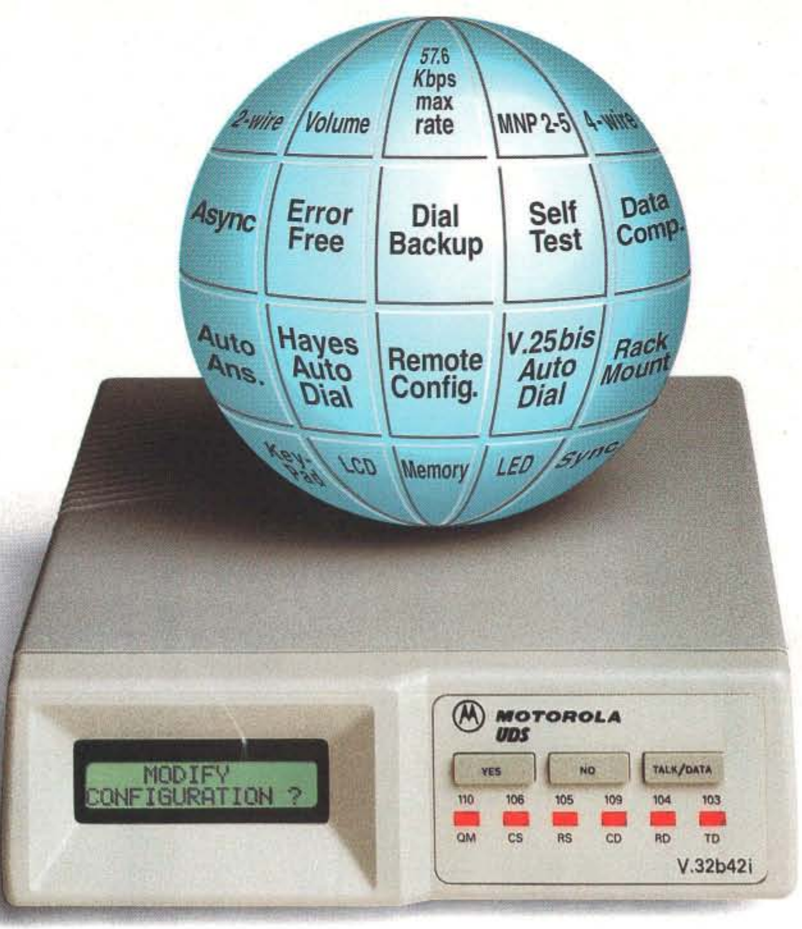

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A world of modem superiority in a very local package

For an international environment where data communications demands are increasing almost daily, Motorola UDS offers a modem that meets local standards with a world-class set of operating features.

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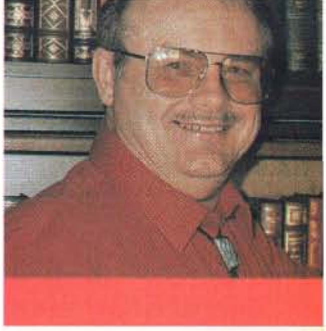


JERRY POURNELLE

LAN WARS

Windows for Workgroups and LANtastic for Windows duke it out at Chaos Manor

They're doing it to us again. Back in the early 1980s, the first big boom in small computers was stalled when the U.S. government created a cartel to force the Asian suppliers to charge us a lot more for memory; that, in turn, drove up the price of cheap clones, with the result that we all paid more for our machines. Unfortunately, it's happening again: government actions are driving memory costs up. This means fewer computers will be sold, meaning less software sold, meaning a slowdown in our industry's growth. So it goes.

Bits Ain't Bits

Windows likes a large amount of memory. It's true enough that you can run Windows with 4 MB, and I do that on my laptops; but when I'm home, I like to have a lot of windows open at once. Typically I'll have Norton Commander, Franklin Ascend, Q&A, Q&A Write with Word Finder and the Definitions Plus American Heritage Dictionary, Word for Windows, a CD-ROM window, and probably a communications program open at all times.

From time to time, I bring in other stuff, like word processor format converters, accounting and bookkeeping systems, and new programs I'm trying out for the column. Add all those up, and 8 MB isn't too much. Bring in a programming language—Visual Basic or Borland Pascal in my case—and a drawing program for doing maps for my stories, and it strains that 8 MB to the limit.

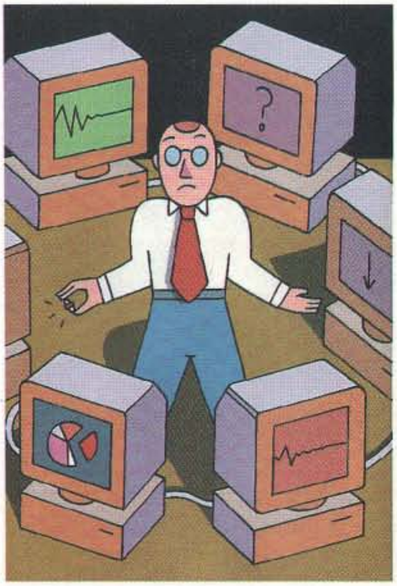
Indeed, at 8 MB I ran out of resources often enough that I decided my primary system ought to have 16 MB. That caused a minor problem most people wouldn't have: what is my main system? What makes this column different is that I *use* the stuff I write about, so unless I'm going to write about one machine and one only, I have to keep swapping systems around. That's part of the fun, of course, but it also means that I needed more memory for several machines, not just one. Still, I thought, memory is cheap. I ordered 20 MB, which I figured would cost under $1000. My intent was to put it in my various machines, and when it was time to send those machines back, I'd just take my SIMMs out and use them again in whatever new systems replaced them.

Wrong on two counts.

First, memory used to be cheap; but then my government helped me by threatening high tariffs on Korean imported memory. The price of memory just about doubled in a week, and as I write this, it doesn't look like it's coming down soon. I suppose it shouldn't surprise me. Every time the clone makers have threatened the big companies in clone wars, the government has intervened to keep computer prices high; why not this time? Of course, that plus the FCC regulations kills off U.S. startups before they're born while helping overseas competitors, but so it goes. Anyway, my 20 MB cost considerably more than I'd intended.

Second, memory for one system may not work in another. Example: I have two Gateway 2000 systems. We love them. One is a 486DX2/50, and the other is a 4DX2-66V. The 486DX2/50 uses conventional SIMMs, and Alex quickly upgraded it to a 20-MB system. The 4DX2-66V, on the other hand, uses an entirely different configuration, one Alex and Barry Workman had never seen before, and I'll have to get memory for that one directly from Gateway (they sell it at reasonable prices). Meanwhile, I find, my Cheetah 486/33 uses yet another memory form factor, and that was even trickier to find.

The result is I have some expensive memory I can't use. It's not a disaster. I can always find places to put memory—caching drive controller boards, older systems I've donated to schools—but it is annoying, and the moral of the story is, memory isn't standard, and what looks like a bargain may turn out not to work in your machine. Pournelle's law: if you don't know what you're doing, talk to dealers who do. I didn't, and I should have.



This Time for Sure

Every year we hear that this will be the Year of the LAN. What with Microsoft pumping millions into advertising Windows for Workgroups, and every other LAN maker jumping onto the network bandwagon, this may really be it. Anyway, after several false starts, 1993 certainly is

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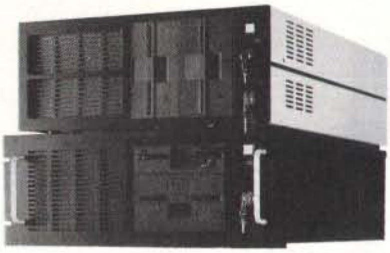

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the Year of the LAN for Chaos Manor.

The question is, which LAN?

It's not a simple question, and worse, it can't easily be broken into the simpler questions of hardware and software, because the hardware you choose limits what software you can run; the software you like today may not be what you need tomorrow; and neither software nor hardware is all that cheap.

You have to start somewhere, so I figured I'd start with what looked like the simplest possible LAN: two machines linked by Windows for Workgroups.

Ohmmmm, Ohmmmmm

LANs are standard in businesses large enough to afford an information services manager or networking guru, but they haven't caught on with small businesses and home establishments. One reason is their complexity; and part of that complexity is the choice of networking hardware. Do you use ARCnet, Ethernet, Token Ring, or perhaps LANtastic nine-pin twisted pair? Whose Ethernet? Thin-wire, thick-wire, or twisted-pair Ethernet? Intel boards? Artisoft LANtastic boards? Thomas-Conrad 10Base-T? I had every one of those. Now what?

First things first. Since I intended to hook up Windows for Workgroups (henceforth WFWG), it made sense to use the EtherExpress 16 boards Intel sent at Microsoft's request. This is what will be bundled into the WFWG Starter Kits Microsoft will be aggressively marketing about the time you read this; and since the boards are software configured—no jumpers or DIP switches to set—I figured it would be the simplest way to start.

The instructions were simple enough. First open two computers and install the boards, and then run the Intel Softset program to configure and test them. That turned out to be as easy as it sounds, and I was done in under an hour. Now to connect the two machines.

Unfortunately, while I'm sure that when Microsoft actually ships WFWG Starter Kits they'll include cables and instructions for connecting them, I'm working with late beta versions; and what I got was a box of boards, some disks, and very minimal instructions. The boards have two connectors on the back: a DB-15 (the same size and shape as a game port) and a BNC coaxial cable connector. There is also a version of the Intel EtherExpress board that has an RJ-45—it looks like a big telephone jack—in place of the BNC.

The DB-15 is for thick-wire Ethernet and won't concern us. The big phone jack is for twisted pair, which will probably be what I want for a permanent installation, and I'll get back to that in a bit. For the moment, what I needed was the BNC: thin wire, sometimes known as cheapernet.

This takes 50-ohm cable, designated RG-58. You can buy RG-58 cable in bulk and add your own connectors. If you choose to do it that way, good luck: faulty cable connectors are the most common cause of network problems. I didn't take that chance. RG-58 with connectors installed is available in various lengths at most electronics stores, including Radio Shack. At Radio Shack, for some reason it's known as 51-ohm cable, but it's the genuine article and works quite well.

Setting Up

I had the boards installed and had run Softset to configure them in the two machines I'd selected for the tests: Cheetah 386/25 and Cheetah 486/25. The 386/25, incidentally, began life as a 386/15. When Intel developed the faster 386/25 and 387/25 chips, I wangled one of the first sets they let out of the company; it's thus one of the oldest 386/25 machines in existence. That Cheetah served as my main machine until it was replaced by a 486. I figure to load it up with assets like the Pioneer DRM-604X Minichanger CD-ROM drive and a big optical drive, connect it to the Kyocera Ecosys laser printer, and let it be a network file server. Anyway, now that I had the boards installed and configured, I connected the two machines with a Radio Shack RG-58 cable.

WFWG can install as an upgrade to an existing Windows setup, and that's the way most will use it, but just to be on the safe side, I deleted all traces of Windows on both machines and started from scratch. As usual, I had some minor problems with the Setup program: possibly the 3½-inch drive on the Cheetah 386/25 is a little out of line, because at Disk 5 Setup simply refused to recognize that this *was* Disk 5. Eventually I convinced it.

When you install WFWG, you give each machine a name; in addition, you must name the workgroup you want to join. Once that's done, WFWG looks just like Windows 3.1, except there's a tool bar across the top of File Manager, a Network icon in the control panel, and a couple of interesting new icons in the Accessories group.

The icons do about what you expect them to; that is, click on the Network icon, and it will log you into the network. In the File Manager tool bar, there's an icon of a hand holding out a folder: click on that, and you can specify which files, file directories, or disk drives you want to make available across the network.

The network configuration was simple

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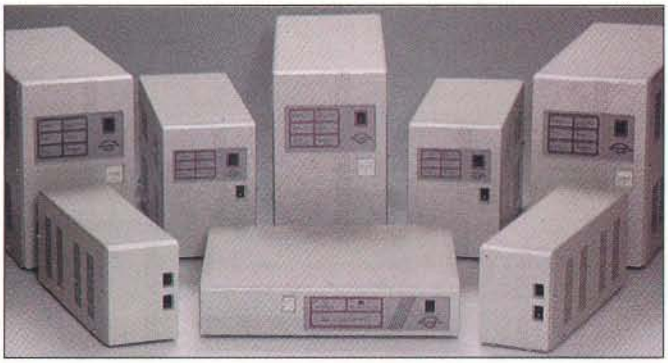

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and intuitive. There was one problem: I couldn't access anything across the network.

Terminate with Prejudice

All this was late at night, with this column due. Since the WFWG software seemed to be working just fine, I figured the problem was hardware; so the first thing was to exit Windows and run the Softset diagnostic programs. Unfortunately, I couldn't do that. Softset works only if you disable all network drivers and reboot. Well, all right, go into CONFIG.SYS and REM out all the device drivers WFWG had installed—there were several—and then reboot and try Softset again.

The diagnostics had three options: test the board, test the network, and turn this board into a network responder to allow testing from another station on the network. That seemed simple enough. Test the board. Fine. Test the network: nothing responding, and after a while it said I should check the cable. Fine. Go to the other machine, disable all network device drivers, reboot, run Softset, test the card—it's fine—and configure that as a network responder.

Alas, no joy. Check the cable. Use an ohmmeter to check continuity. Seems OK to me. Reconnect. Still nothing. I ground my teeth, wrote some other stuff for the column, and went to bed.

At this point, experienced Ethernet users are laughing their heads off, so I'll finish this story quickly. I got on-line to BIX and asked for help; within an hour, Jeff Sloman sent a note asking if I had properly terminated my Ethernet cables. Since I had no idea what *termination* meant, clearly I hadn't; time to call Barry Workman for some elementary instructions.

Ethernet thin-wire systems connect in a daisy chain, each machine connected to the next, so what connects to the board in each machine is a T connector. Since I had only two machines in this loop, I hadn't known that I needed to connect them using T connectors, but that was the trouble. At each end of a thin-wire Ethernet system there must be T connectors, with a little metal 50-ohm terminator cap on one branch of the T. Moreover, not all terminator caps are 50 ohms: ARCnet terminators are 96 ohms, and there are other values. In theory, the 50-ohm connectors are color-coded green, but in fact many are bare metal.

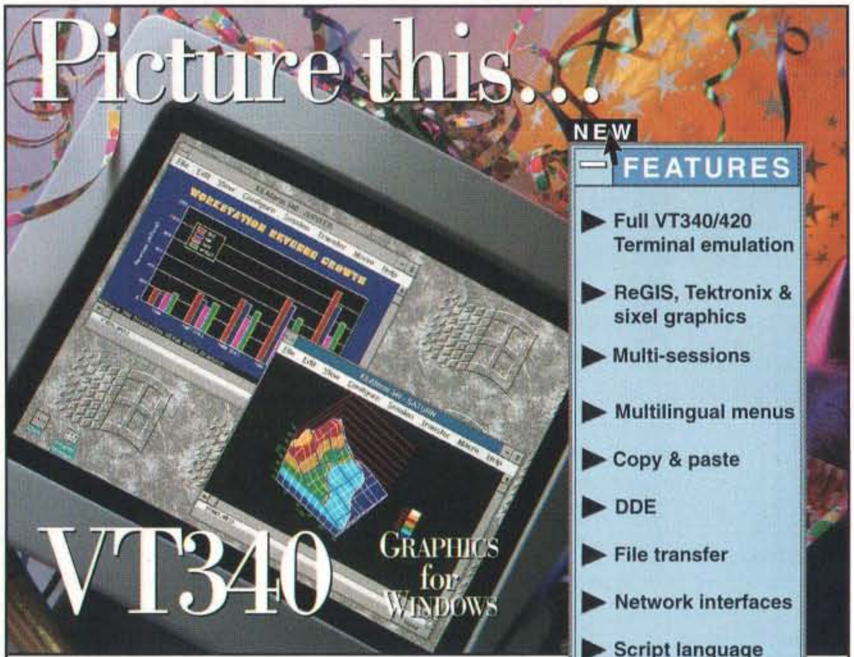
Once I knew what to do, it was all pretty simple. I found a pair of T connectors and terminators that had come with Artisoft's Ethernet Starter Kit, tested with a multimeter to see that they were in fact 50 ohms, and connected the machines properly. When I ran the Softset network diagnostics everything was just fine, so I edited the CONFIG.SYS files to put the device drivers back in, rebooted, started up Windows, and—voilà!

Well, not quite, because I hadn't un-REMed all the relevant statements in CONFIG.SYS and AUTOEXEC.BAT on both machines, but when that was done, all was well. I could share and transfer files and programs, examine schedules, and generally do networkish things, all in a very natural manner.

The bottom line is that if you connect the hardware properly, setting up a WFWG LAN really is as simple as adding the boards and running the software. I sure wish I'd done it that way.

Adding to the Network

My next step was to move the T connector with terminators from the 386/25 to my main machine, the Cheetah 486/33, putting a simple T connector on the 386/25; this



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We're much obliged to ***PC Magazine's*** readers who gave us the best overall score in *PC Mag's* 1992 Service and Reliability Survey.

Our humble thanks to the readers of ***PC World***. They honored us with two World Class Awards in 1992 – one for the Gateway 4DX-33 and another for Service and Support.

Our hats are off to ***Compute*** magazine for presenting us with 1992 Best Desktop Computer for the Gateway 4DX2-50.

We're thrilled that ***Popular Science*** magazine recognized the Gateway HandBook portable PC as one of 1992's "Best of What's New."

And thank you ***BYTE*** magazine for an Award of Distinction for the HandBook. *BYTE* readers also chose the Gateway 486DX as Desktop Computer of the Year.

Finally, we applaud all our loyal customers. Without your unwavering support throughout the years, Gateway couldn't have won these honors. We owe our success to you, and we'll be forever grateful. Here's to another great year in 1993!

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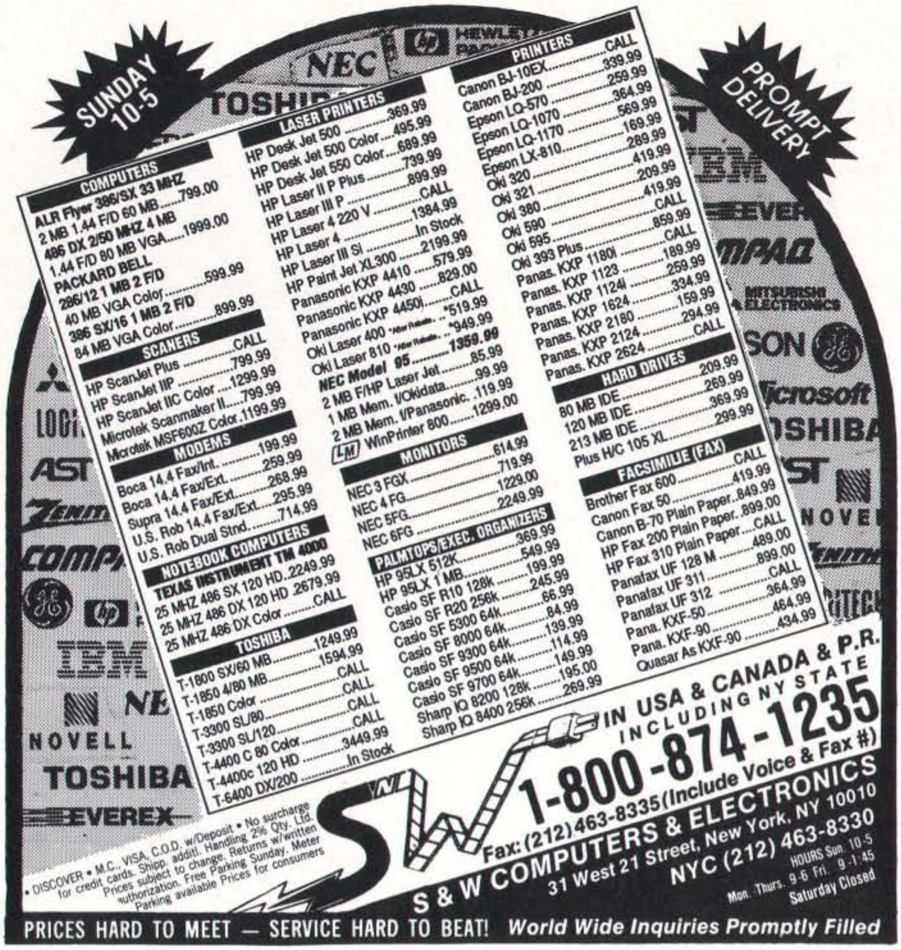

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gave me a daisy chain from the 486/33 to the 386/25 to the 486/25. Then I upgraded Windows 3.1 to WFWG and logged onto the network—and this time everything really did go as smoothly as all that, no problems whatever.

Flash: I've now seen the shipping version of the Microsoft WFWG Starter Kit. It includes instructions, a video, the cables and T-connectors and terminators, and even a screwdriver: about as complete and easy-to-use a kit as I have ever seen. If I'd had this, I wouldn't have had any problem at all.

Thin-Wire Blues

Since thin wire works so well and installs so easily (once you know how to terminate each end), why consider anything else?

The problem is that thin wire can be daisy chained only in a bus topology; and if any machine is disconnected from the network, whether deliberately or because of a bad cable, the whole network dies. Moreover, there's a long history of thin-wire cable problems, particularly if you make the cables yourself.

The alternative is twisted pair, which you'll remember has RJ-45 connectors that look like oversize telephone jacks and which connects with cables much like telephone cable. The advantage of twisted pair (otherwise known as Ethernet TP and officially as 10Base-T) is that you configure the system as a star (also known as *home run*): every cable goes to one central point, where they are all connected together. As long as any two machines are still connected to the network, you can transfer files between them. You can also have bridges from one star to another.

The disadvantage is that each star hub must have a *concentrator* into which all the 10Base-T lines run. The concentrator can be a stand-alone box or a board installed in a computer that you'll use as a network server; that board will also serve as the network card for the server machine. Concentrators can also accept thin wire as well as twisted pair. Concentrator costs vary, but they generally run around $500 to $1000, depending on the number of ports you need.

I'll have more on this another time. The goal here at Chaos Manor is to have twisted-pair lines run from nearly every room to a central concentrator box in the telephone closet. Note that a stand-alone concentrator need not be located near any computer at all: the network server is just another line into the concentrator if you use that scheme. Anyway, that's what we mean to end up with, and you'll get progress reports as I go.

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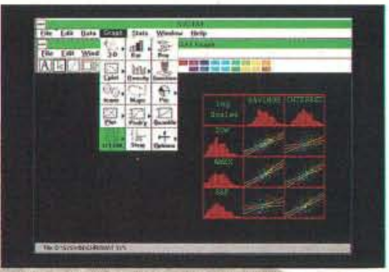

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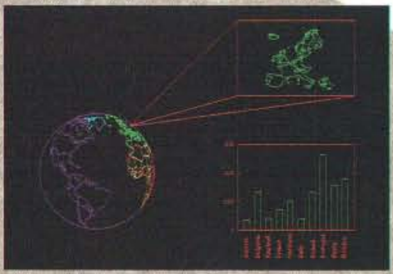

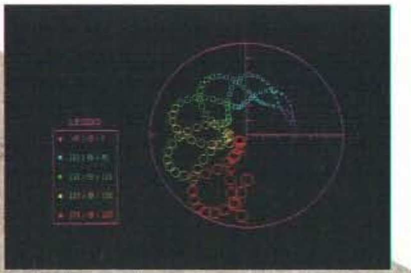

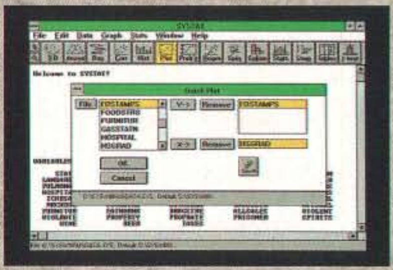

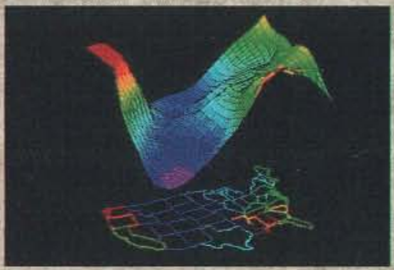

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The LANtastic Alternative

One alternative to WFWG is Artisoft's LANtastic for Windows. I'll be comparing WFWG and LANtastic in the next few columns. Each has strong points.

Whether you use LANtastic or WFWG, you should strongly consider getting cards that have both thin-wire and 10Base-T interfaces. LANtastic's boards have all three: thin wire, twisted pair, and the DB-15 thick wire (which few places use now). Thin wire is easily set up, and you can lay the lines on the floor for testing the system. Once you know where you want lines, it's cheaper to have 10Base-T cable pulled through the walls. As your LAN grows, you'll find that cabling costs aren't trivial.

Finally, if you connect up your WFWG with LANtastic boards, you can set up software controls to run your system with WFWG, LANtastic for DOS, and LANtastic for Windows. (You cannot run LANtastic and WFWG simultaneously; it's one or the other, but never both.) For that matter, you can install just about any network software known, including full-blown NetWare 3.x, with LANtastic cards.

That kind of flexibility is worth having. However, fair warning: installing LANtastic boards is not as simple as installing the Intel EtherExpress 16. There are jumpers to select I/O addressing, IRQs (interrupt requests), and other such matters. The manuals, while complete, tend to assume knowledge of things you may not know. While Softset goes out and looks at what's happening in your system, chooses the proper settings, and configures the board, all in software, LANtastic boards require you to use some program like WinSleuth or Checkit to be sure there are no addressing and IRQ conflicts. (Another way is to cheat: install an Intel board, run Softset, write down the settings Softset recommends for the Intel board, and set the LANtastic board up that way.)

In a word: setting up with LANtastic boards will give you a considerably more flexible system, but you'll have more trouble getting it running. Clearly, it's not *that* much trouble: Artisoft is now one of the largest suppliers of Ethernet boards in the country.

Finally, if you do get the Microsoft/Intel Starter Kit and go with thin wire, you haven't locked yourself out of using LANtastic later on; LANtastic will run with the Intel boards.

And that's enough on networks for this month. More next time; indeed, networking will be a major theme all year.

Hypertext Help

There's no excuse for releasing Windows products without adequate help files. By adequate, I mean well indexed, with index entries for the operations your customers will want to perform and with live cross-references, otherwise known as hypertext. If you include a glossary (and in most cases you should), that ought to be linked in so that you can get pop-up definitions of terms from inside the help screen rather than have to go look things up.

All that and more can be done by using Doc-to-Help from WexTech Systems. Doc-to-Help requires Word for Windows 2.0 (and Windows 3.x itself, of course). What you get is a system for converting Word for Windows documents into indexed hypertext documents, using those to build help files and compiling the help files so they'll work in Windows. The package includes the Microsoft Help Compiler, but fortunately you don't need to know much about how that works.

The indexing capability is limited and a

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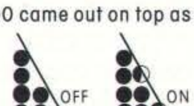

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bit awkward, but you can get the job done. You can mark words; that pops up a dialog box to let you assign tags to the words. It's all right, but sometimes I prefer to have a computer program build a list of all the words in the document and then go through and eliminate the ones I don't want indexed. There are indexing programs that do that, and more, but this isn't one of them. On the other hand, you can browse through your document and enter index key words as you encounter them, and Doc-to-Help will take care of things from there. It's considerably easier than using a card file, and most rival products don't have indexing at all.

The Doc-to-Help system is essentially a way to take paper documentation and convert it into on-line help files. The process is fast and painless: enormous existing documents can be turned into hypertext help files in days rather than weeks. Alternatively, by intelligent planning, you can create both documentation and on-line help for any project as you build the product itself.

If you're developing Windows products, you need this. Recommended.

Update on Viruses

I continue to recommend Dr. Solomon's Anti-Virus Toolkit for DOS. All my research indicates that the software does as good a job of detecting virus threats as any product I know, and furthermore, the S&S International staff vigorously seeks out new viruses and disassembles them, so it's kept up to date. The explanations of what viruses are and what they do are excellent; and *Dr. Solomon's Virus Encyclopedia*, which now comes with the Toolkit, explains every known virus in considerable detail.

Having said all that, I have a warning.

S&S now sells a version of the Toolkit for Windows. Don't buy it, don't rely on it, and don't use it.

The only way you can run a program under Windows is to boot up your machine and then run Windows. That gives a virus a chance to go memory resident. I won't go into details, but a well-written virus, once memory resident, can evade just about every virus-detection scheme. Most won't, but some can.

The only way to be certain that your system isn't infected is to boot it with a known clean floppy disk and then run (preferably from a write-protected floppy disk) a good virus-detection program, like S&S's Toolkit for DOS. This is the advice Dr. Solomon and S&S International have always given, and good advice it is, too. Incidentally, the Toolkit for DOS comes with the Toolkit for Windows, which is just fine, but why pay for the Windows version in the first place?

Death Threat

I would like to perform a public service: I want to kill the mechanical engineer who designed the board system for the IBM PC bus—the one who put the little tabs on the bottom ends of the board mounts. For my own personal satisfaction, I would like to use something lingering with boiling oil, but the public service would be to see that this engineer doesn't work on anything else.

The system is unbelievably dumb; it's as if it were designed for computers that will never have boards changed and will not be moved around. Boards get loose. You can't get the screws in. If you try to change a couple of boards, you can tear half the flesh off your fingers and the backs of your hands.

For those who are going completely nuts installing boards, I have a tip: get a pair

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✓ Unbreakable electronics. A customized ASIC (Application Specific Integrated Circuit) component should be integrated in the key. This prevents reverse engineering and makes cracking virtually impossible.

✓ A unique and inaccessible software developer's code burnt into the ASIC. (This code should not be held in the key's memory, where it can be read and altered.)

✓ A Read/Write Memory inside the key should be available on demand. The memory should be writable in the field, on any PC, without any special programming equipment.

✓ Very low power consumption, enabling the key to work even under the worst power conditions, on PCs and laptops, with or without a printer.

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Since it's practically impossible to crack or duplicate a key having all the features mentioned above, a pirate will usually go for the software linking the protected program to the key. Therefore, check that your protection software has all of the following:

✓ A Linkable Protection Module with which calls can be made to the key from any point in the protected program.

✓ An "Envelope" installation program. Such programs enhance security while making it possible to protect a software even without its source code.

✓ Sophisticated antidebugging and encryption mechanisms.

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✓ A Pattern Code Security System (PCS) enabling parallel processing of multiple calls by the Linkable Protection Module.

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of big, heavy metal-cutting nippers—and cut the stupid little tongue off.

LaserMaster

A quick note about LaserMaster. The National Association of Theater Owners has adopted the LaserMaster WinJet, Aldus PageMaker, and Windows to do all their publications, including the program for their yearly convention.

I have reported on the WinJet before: it installs in your Hewlett-Packard LaserJet III and connects to another board in your Windows computer. The result is that it does the raster-image processing in your computer and squirts that to the printer, making the whole process incredibly fast compared to what PageMaker normally does. For single-user desktop layouts and publications, it's hard to beat. Alex installed the system some time ago and says the only calls he gets from that customer are to tell him how terrific it is.

The Mail Dilemma

I like MCI Mail. It's not as elegant as AT&T's E-mail service, but it has been around a long time, a lot of people I want to talk to are on it, and I'm used to it. Every now and then, there's a glitch. The most common one used to be that some new PR firm would get on, discover just how many columnists and editors and freelance writers are on MCI, and build up an enormous mailing list to which they'd send new product announcements. Unfortunately, they wouldn't study the manual on how to handle mail lists, and the result would be that it would take 10 minutes to download the header and "To:" list before the message came in. The first time that happened, I thought it was amusing, and besides, I got a good mail list out of it. The next dozen times weren't so funny.

The main reason I use MCI Mail, though, is that Norton Commander has a built-in front end for it. Set Commander up properly, and you can tell it to go get your MCI Mail. You can then read that mail and reply to it off-line. The next time Commander goes forth to MCI—either because you sent it manually or because you set it to do it automatically—it will first send out all your replies and other messages. This can all happen invisibly in the night or in the background while you work on something else. Lotus Express uses the same method to achieve the same result.

Alas, the past few weeks when I sent Commander after MCI Mail, it failed as often as not. Sometimes it would get "ring no answer," which is understandable at busy times; but often I'd get an answer, the system would appear to lock on at 2400

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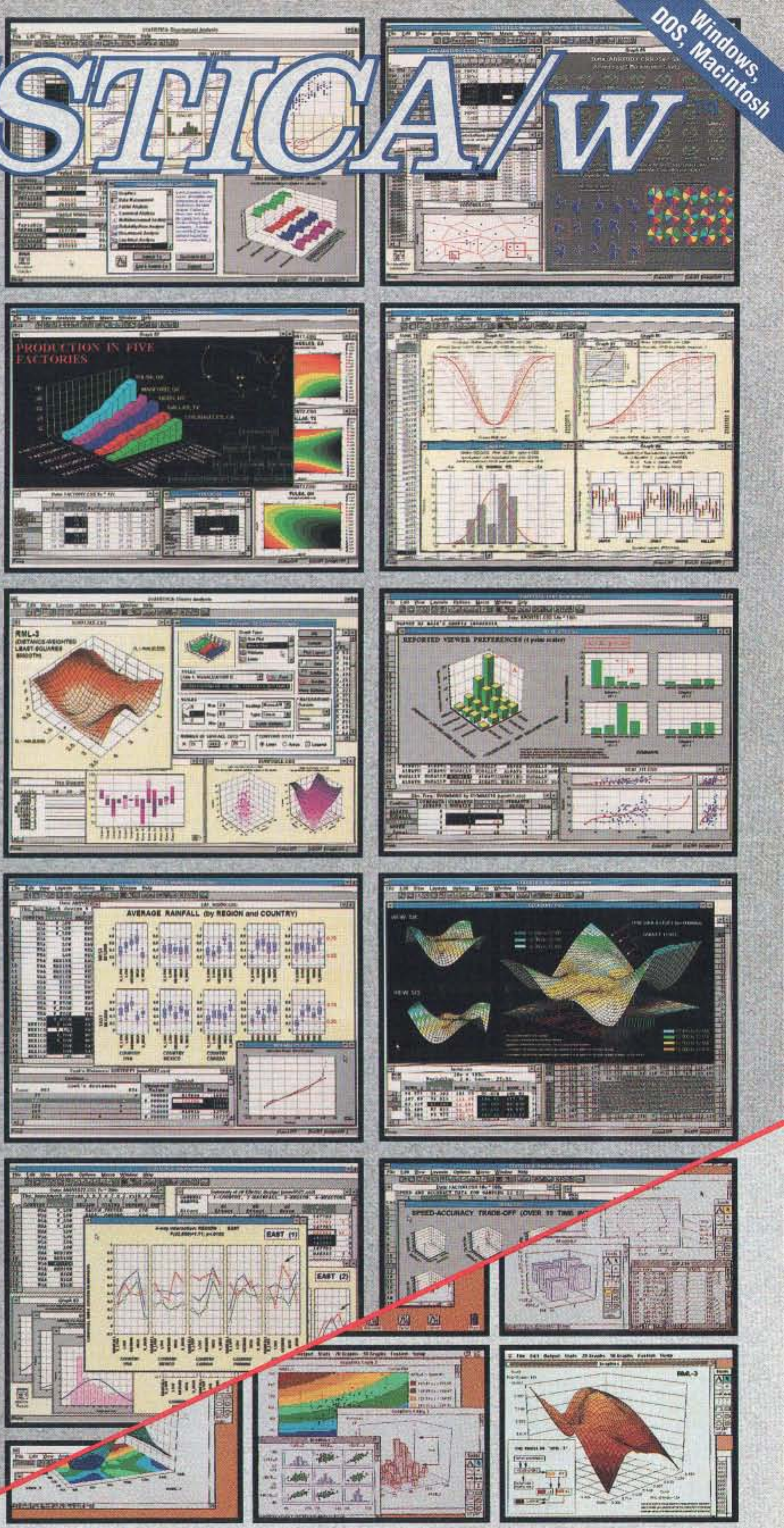
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bps, and then it would never gain admission to MCI. Once that happened 50 times in a row.

The remedy turned out to be simple: although Commander tells you to enter the highest speed for your modem (up to 9600 bps), you shouldn't do that. Instead, set 2400 bps, which is the highest speed I've ever seen it lock on anyway. That won't end "ring no answer," but it does stop the nonsense of not being able to handshake with the MCI Mail modems.

I'm told that MCI will bring out its own front-end program Real Soon Now, and perhaps that will be superior to Norton Commander. Until then, I have Commander Mail with its own Windows PIF (program information file), 2500 ticks in foreground and background, and it's good enough.

SuperCard

Roberta is jazzing up her reading program and transferring it to other systems. Part of that is being done by Chris Innanen, who's converting it into SuperCard for the Mac. SuperCard is, unsurprisingly, a superset of the HyperCard programming toolkit for the Mac. Actually, it's quite a lot more than that. They don't call SuperCard a multimedia programming language because that might frighten off potential customers; but in fact, SuperCard is powerful enough to create commercial-quality stand-alone programs while remaining easy to use.

I have said for years that the real goal of the computer revolution is to get ordinary users developing computer applications. SuperCard and Apple's Mac together are a giant step in that direction. With SuperCard you can build simple programs employing sound and graphics to achieve complex results. You can also build very complicated programs: Supercard contains most of the BASIC control structures, such as IF…THEN, DO WHILE, DO UNTIL, and FOR…NEXT (the last three are found under the REPEAT command).

SuperCard contains SuperTalk, animation tools, and suchlike. It has a debugger (called a run-time editor). It creates objects; and of course it integrates all this rather seamlessly into the Mac Desktop environment. Roberta, who has no interest in programming except as a means of getting her education programs running, is quite thrilled with SuperCard's capabilities. You may also want Aldus SuperPaint, which makes drawing with SuperCard a bit easier.

Both SuperPaint and SuperCard were developed by an outfit known as Silicon Beach, before it was bought out by Aldus. I keep hearing hints of a new-and-improved SuperCard, but don't let that stop you from getting it now. Aldus has always had reasonable upgrade policies.

If you're a Mac user thinking about developing programs but afraid that will be too hard, get SuperCard. It's a great introduction to how to make your machine do things for you. Recommended.

PowerBook Note

If you use LapLink Mac with a PowerBook and it just won't link up, open the Control Panel, open the Portable icon, and click on external modem. Like a lot of Apple interface commands, this is obvious once thought of, but it's not precisely intuitive.

PowerBooks are showing up all over the place now. Older ones are offered at astoundingly low prices, low enough that we've thought wistfully of bundling Roberta's reading program in with one as a stand-alone learn-to-read kit. We won't do that, but I wish someone would.

continued

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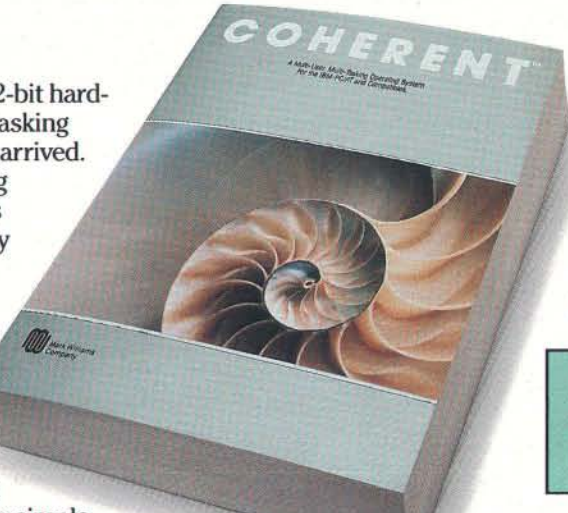
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Quotemaster Plus

Instructions on installing this for Windows aren't clear, but otherwise it's not a bad program. The quote list is different from *Bartlett's Familiar Quotations*, which may be all to the good. It's easy to use, and there are other subject quote lists available that use the same search engine.

It's a reasonable tool for spicing up a speech or essay, and I found a couple of quotes to use as aphorisms at chapter breaks. It's worth having a look at if you deal in words.

Programmer's Tool

Alloc-GC is a garbage-collecting replacement for the allocation functions that come with C compilers. Programs that use it don't need to explicitly deallocate memory, because unreferenced blocks are reclaimed and reused when memory runs low. C++, like C, uses explicit deallocation; garbage collection is used in Smalltalk, Lisp, and suchlike.

I make you aware of it. I don't like C++ much better than I like C, but if you use C++, you might try this; it's said to simplify the code and eliminate some of the bugs caused by having to write destructors and deallocations.

They're Back

Amiga and Commodore America have come back in a big way: new machines, great new plans. More in the future, but if you're curious about what's available for the Amiga, a simple way is to get Commodore's *Guide to the Amiga* from Pim Publications (P.O. Box 2140, Fall River, MA 02722). It describes and gives sources for about 10 zillion Amiga programs and accessories. You might be amazed at how much there is.

Winding Down

The onion of the month goes to the Library of Computer Information and Sciences, which for two years continues to send to "Estate of Barbara Yost" solicitations to rejoin the book club, to the annoyance of her heirs and despite repeated protests.

The Gripping Hand (Simon and Schuster), by Larry Niven and Jerry Pournelle, is the sequel to *The Mote in God's Eye*, and it should be available in bookstores about the time you read this. We wrote *Mote* in 1972, and I'm pleased to say that we haven't had to do much updating of the computer capabilities we built into that book.

Books of the month: Kris Jamsa's *Concise Guide to Windows For Workgroups* (Microsoft Press, 1992). It's a quick introduction to WFWG features. If you're at all interested in writing for the audiovisual field, a good introduction is the new edition of Dwight and Joye Swain's *Scripting for the New AV Technologies* (Focal Press, 1992).

Next month: Space Adventure from Knowledge Adventure (you'll love it); a lot more about networks and networking; and, with luck, just a lot of CD-ROMs that have accumulated at Chaos Manor. Now I'm off to the Hackers' Conference. This year I'm taking MIT's Marvin Minsky, which ought to prove interesting. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryp."

ITEMS DISCUSSED

Alloc-GC
personal version......$30
commercial version......$130
Codewright's Toolworks
P.O. Box 990
San Pedro, CA 90733
(310) 514-3151
Circle 976 on Inquiry Card.

Doc-to-Help......$295
(plus shipping and handling)
WexTech Systems, Inc.
310 Madison Ave., Suite 905
New York, NY 10017
(212) 949-9595
fax: (212) 949-4007
Circle 977 on Inquiry Card.

Dr. Solomon's Anti-Virus Toolkit for DOS 6.01......$149.95
Dr. Solomon's Anti-Virus Toolkit for Windows 6.01......$195
Ontrack Computer Systems, Inc.
6321 Bury Dr., Suite 15-19
Eden Prairie, MN 55346
(800) 752-1333
(612) 937-1107
fax: (612) 937-5815
Circle 978 on Inquiry Card.

LANtastic for Windows
A2Mbps Starter Kit......$499 to $599
AE-2 Ethernet Starter Kit......$699 to $799
AE-3 Ethernet Starter Kit......$799 to $899
10Base-T Ethernet Starter Kit......$899
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LaserMaster TrueTech 1000 Laserprinter......$6995
WinJet 300......$495
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fax: (612) 944-0522
Circle 980 on Inquiry Card.

Norton Commander 3......$149
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Quotemaster Plus
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professional version......$270
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SuperCard......$199
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fax: (619) 695-7902
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Windows for Workgroups......$249.95
Windows for Workgroups Starter Kit......$849.95
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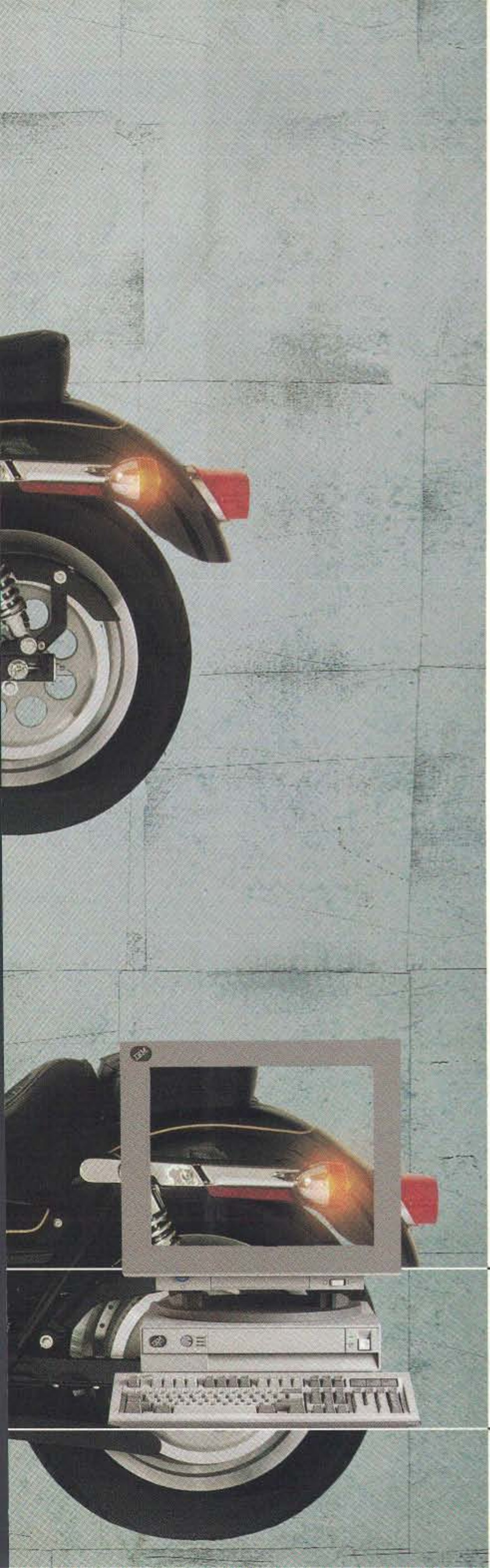

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Affordable do-it-yourself CD-ROM publishing will revolutionize how you distribute and use information

JON UDELL

When BYTE first featured CD-ROM on its cover in 1986, we said it would reinvent publishing. Today, CD-ROM is finally poised to deliver. CD-ROM drives are now faster and cheaper, and with the installed base (now estimated at 5 million) doubling every year, text-based and multimedia titles are proliferating. Kodak's Photo CD system establishes CD-ROM as a key ingredient in digital photography, and software makers are flocking to CD-ROM as a convenient alternative to distributing code and manuals. Businesses increasingly find CD-ROM a compelling medium for internal communication. And for governments obliged to distribute data to citizens, the medium of choice is becoming CD-ROM.

Into this bubbling mixture now drops a catalyst for even more rapid acceptance of CD-ROM: sub-$10,000 CD-R (CD recordable) drives that bring CD-ROM-making to the desktop. These new low-cost printing presses will shift the electronic publishing revolution into high gear.

CD-R is ideal for three kinds of applications: prototyping titles destined for conventional pressing, final production of discs for limited distribution or even single use, and archiving. Low-volume production is CD-R's forte.

At the National Library of Medicine (Bethesda, MD), a research library within the National Institutes of Health, searching for medical periodicals until recently meant wading through fat notebooks full of printouts. Now that data finds its way onto a custom CD-ROM. A single copy of the disc, produced monthly using the Sony CD-R drive and placed in a networked CD-ROM reader, gives researchers electronic access to medical citations.

Macess (Birmingham, AL), a developer of turnkey document-control systems for the managed health care industry, uses CD-R to store scanned images of claims forms. The discs reside in huge banks of networked CD-ROM readers, and Macess's software marries CD-ROM-based document images to fielded data in Btrieve databases kept on NetWare servers. One of Macess's clients scans more than 10,000 forms a day. When the accumulated image data reaches 600 MB—which happens once or twice a day—it's written to a CD-R disc using a Philips drive. The total capacity of the system will soon double to 168 networked readers and nearly 100 GB of document images.

The SAS Institute (Cary, NC), developer of the statistical software package that is called SPSS, uses the Makedisc software from Young Minds and the Philips

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Affordable CD-R Drives

JON UDELL AND HOWARD EGLOWSTEIN

Once you read your first handmade CD-R disc in a standard CD-ROM player, you'll be hooked on the power of this exciting technology. Desktop CD-ROM recording is very new, though, and like any pioneer you should expect some of the hardships we encountered when we tested four of the current crop of CD-R solutions (see photo A). Their very different approaches to both hardware and software attest to the embryonic state of CD-R.

CD-Studio, YMI

We wondered how this deluxe solution for Unix-based CD-ROM makers could guarantee that a Unix host will sustain the 300 Kbps required by the double-speed Philips CDD 521 included with the package. The answer is that it doesn't have to. Young Minds, Inc., inserts a proprietary controller (shown in photo A) between the host and the recorder. The package sells for $18,250.

The CD-Studio controller is essentially a headless PC (i.e., no monitor or keyboard) with two high-performance SCSI adapters and a 1-GB disk. One adapter handles communications with the Unix host; the other talks to the Philips recorder. The controller powers up running custom YMI code that makes it appear to Unix as an 8-millimeter Exabyte tape device. To test that it's working, you can use the Unix `tar` command to copy files to the "tape" and read them back. What you can't do, though, is verify that the CD recorder is properly hooked up. We wish YMI had added LEDs to the controller's front panel to monitor the status of the recorder.

Our Unix test-bed was a Sun Sparcstation 2 running SunOS 4.1.2. YMI's `Makedisc` walked the tree of sources we fed it and built a 620-MB CD-ROM image on the controller's disk. To transfer that image to the recorder, we issued a standard Unix `mt` (mag tape) command, which tells the YMI controller's pseudo–tape device driver to start the recorder. After that, there's no feedback from the Unix console or the controller. You simply watch for the CDD 521's write LED to turn off.

Everything worked smoothly, and our first disc was a success, although even BYTE's Unix experts found YMI's documentation cryptic. Because we used `Makedisc`'s -R option to add Rock Ridge extensions, the resulting CD-ROM had the look of a Posix file system (e.g., long names, symbolic links, and permissions) when mounted in the Sparcstation's CD-ROM drive. (DOS and Macintosh systems saw the same disc as a standard ISO 9660 CD-ROM.)

`Makedisc` also stores descriptions of the Unix–to–ISO 9660 mapping in a text file at each node of the ISO 9660 tree. That way, Unixes other than the two that now support Rock Ridge (SunOS and NextStep) can recover the original names. YMI's `cd_link` enables such systems to map a hard disk–based tree of real Unix filenames to the corresponding tree of short, uppercase-only ISO 9660 filenames on the CD-ROM. YMI also provides an NFS (Network File System)–compatible file system called PFS (Portable File System) that handles CD-ROM sharing over Unix networks more efficiently than NFS.

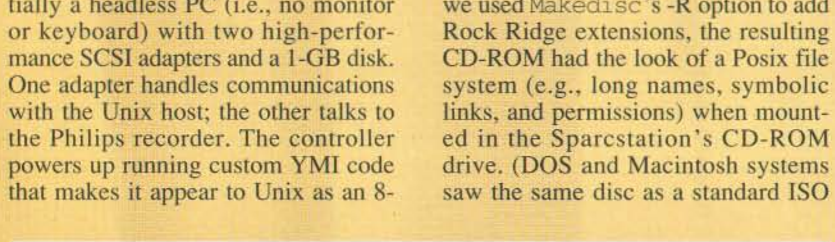

Photo A: *(Clockwise from bottom left): The Sony CDW-900E, Philips CDD 521 (in Kodak guise), JVC Personal RomMaker, and YMI CD-Studio controller.*

Personal RomMaker, JVC

Mastering your disc on JVC Information Products' Personal RomMaker is about as easy as it gets. Personal RomMaker ($12,799) requires a Mac IIci or better, 4 MB of RAM, System 7.x, and HyperCard 2.1 or higher. In addition, you'll need enough disk space to store your original data files, but there's no need for fast storage here: RomMaker can run happily off shared disks or network servers.

To burn a ROM, you need either fast access to the data files or a fast hard drive with a premastered image. JVC uses the latter and incorporates a high-speed Maxtor 8760 SCSI drive into the Personal RomMaker system (this is the same drive we chose for our DOS testing). You create your disc by deciding what files you want stored and how you want them arranged. RomMaker gives you a simple script editor for creating an ASCII list of these files and folders. We'd prefer it if RomMaker used standard Apple file dialogues for selecting files, but the ASCII file syntax is simple enough to handle.

The premastering stage runs through your file list and then copies each file from the Mac's file system to RomMaker's hard drive in CD-ROM format. You can choose from several disc formats: Apple HFS, ISO 9660, High

Sierra, or a hybrid HFS and ISO 9660 format. Our test disc consists of 620 MB of images. To find enough free disk space, we used System 7's file sharing to convert one of our Quadras into a file server. Over a thin Ethernet link, it took about 1½ hours to suck the 620 MB through the network and create the CD-ROM image.

After the premastering, you can mount the hard drive as a CD-ROM image, manipulate the folder and window structure, and test your application. To create the CD-ROM, you simply choose the appropriate menu selection. After verifying that you've placed a blank in the drive, RomMaker trundles off and copies the hard drive contents to the CD-ROM recorder. If you have the optional DAT (digital audiotape) drive, you can opt to copy the image to DAT for a commercial premastering house.

CD Record, Dataware

Dataware resells the Philips CDD 521 for the DOS market with its CD Record software ($8995 for the package). Unlike Philips' CD-Write, which performs ISO 9660 formatting on the fly as it transfers files from a hard disk to the write-once disc, CD Record requires two steps: First build a virtual image, and then write that image to the CD.

First-generation premastering systems, like Dataware's CD Prepare, convert a DOS hierarchy that may contain thousands of files into one huge file that's a bit-for-bit image of an ISO 9660 file system. The image file serves two purposes. With the software emulator such systems typically provide, you can fool MSCDEX into seeing the image as a real CD-ROM. That means you can test your retrieval application before mastering any discs. Once satisfied with the image, you dump it to tape for shipment to a mastering house.

CD-R changes the rules of the game. Now you can build your own test disc, which is also a convenient delivery vehicle. In principle, there's no need for an image file, or for an extra 660-MB hard disk to store it on. But given the high cost of CD-R media, it's still useful to have an image file available for preliminary testing. CD Record's virtual image meets that need—without doubling your storage requirement—by adding a thin ISO 9660 mapping layer to an existing DOS file system.

CD Record has some drawbacks, though. Building that image took us over an hour for our 8000-file data set, and that still left an additional half hour to cut the disc. By contrast, CD-Write, although lacking the useful virtual image capability, does the entire job—formatting and disc cutting—in half an hour. Also, CD Record's virtual image lives in RAM and does not survive a reboot. If you need to make a CONFIG.SYS change after running `vmap` (the ISO 9660 mapper) but before starting `cdrecord` (the recorder), you'll have to rerun `vmap`—an inconvenience that Dataware admits should be fixed.

Hardware trouble botched our first two discs. While DOS can disgorge files fast enough to sustain 300 Kbps to the double-speed CDD 521 for the duration of a write session, conditions must be near-optimal. After rearranging some questionable SCSI cabling, we did successfully cut discs. But the experience reminded us that a more expensive solution involving a dedicated hard disk (e.g., YMI, JVC) is also inherently more reliable.

Multimedia Formatter, Sony

Sony's rack-mountable CDW-900E (not sold at retail) offers several unique features. In addition to the SCSI-2 connectors, its back panel sports an extra pair of proprietary connectors. These enable you to link a master CDW-900E to as many as 15 slaves for simultaneously writing multiple CDs. (Additional connectors, not currently used in any PC-hosted application, support recording audio CD.) The drive's capacious 3-MB buffer helps ensure the sustained flow of data on which CD recording critically depends. Moreover, since it can run at single or double speed, the host need not support the 300 Kbps required by the Philips drive.

Like CD Record, Sony's Multimedia ISO Formatter layers a virtual image on top of an existing DOS file system. However, it provides no emulator, nor can the drive work as an ordinary CD-ROM reader (as the Philips drive does). When you cut a disc from a virtual image, Sony runs the drive at single speed to ensure best results. For faster writing, you have the option of building a real image on the hard disk and cutting it to the disc at double speed.

Like the drive itself, Sony's formatting software has some unique features. In addition to straight ISO 9660 CD-ROMs, it can apply the secret sauce needed to make titles for Sony's Data Discman and MMCD Player. The Data Discman plays 8-centimeter discs that are in XA format but have nonstandard volume information. Another secret recipe makes the MMCD Player's regular-size XA discs. Sony's formatting software, which presents a DOS-based GUI, supports both these formats.

For Unix users, YMI's CD-Studio, with its Rock Ridge support, is a solid—albeit pricey—solution. Mac users who can afford JVC's Personal RomMaker will appreciate its outstanding ease of use and HFS support. For DOS users, both the Sony and Philips drives have their advantages. The Sony CDW-900E's large buffer and single-speed mode could improve reliability in some configurations, and its support for Sony's Data Discman and MMCD Player is unique. The Philips drive, widely supported by resellers, is a solid performer and—at least for now—the most inexpensive CD-R solution.

Jon Udell is a BYTE senior technical editor at large. Howard Eglowstein is a BYTE Lab testing editor. You can contact them on BIX as "judell" and "heglowstein," respectively.

COMPANY INFO

Dataware Technologies, Inc.
(617) 621-0820
fax: (617) 621-0307
Circle 1075 on Inquiry Card.

JVC Information Products Co.
(714) 965-2610
fax: (714) 968-9071
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Sony Corp. of America
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Circle 1077 on Inquiry Card.

Young Minds, Inc.
(909) 335-1350
fax: (909) 798-0488
Circle 1078 on Inquiry Card.

Buying a CD-ROM Drive

TOM HALFHILL

The proliferation of CD standards, including CD-ROM XA and multisession Photo CD, makes it harder than ever to decide which drive to buy. Further complicating the decision is the availability of dual-speed drives that, for a $200 premium, double throughput. One alternative is simply to wait a few months: Drive makers are constantly updating their products, and they say that adding XA or Photo CD support won't be a big deal. But the definitions of these features can be slippery.

Consider NEC's "XA-ready" drives, which can read mode 2 format. To be fully XA compatible, they will need additional circuitry to decode interleaved channels of audio and perform ADPCM (Adaptive Differential Pulse Code Modulation) decompression. To add these capabilities, you're likely to need a new interface card. The same is true of XA-ready drives made by Sony and others. Currently, the only Sony devices with built-in ADPCM chips are the Data Discman and the MMCD Player. Sony says, however, that it will add the relatively inexpensive ADPCM chips to its CD-ROM drives if XA compatibility becomes more important.

So far, the most compelling reason to have XA is Kodak's Photo CD. To read a Photo CD, a CD-ROM drive must be XA ready, although it does not have to be fully XA compatible. However, full XA compatibility with ADPCM will be required for future Photo CD applications that will use interleaved audio. Lacking ADPCM, an XA-ready CD-ROM drive could play sound bites attached to individual images, but it couldn't play a continuous audio track while reading one image after another. For an impressive business presentation or narrated slide show, you'd need full XA.

Another desirable feature in a CD-ROM drive is the ability to read multisession Photo CDs. Several drives can read the first batch of images written to a Photo CD disc. But when you add another batch of pictures, it becomes a multisession CD, and only a handful of drives can track the modified directory structure and locate the additional images.

"I don't think multisession is a big deal," says Pat Fobes, a CD-ROM hardware manager at NEC Technologies (Wood Dale, IL), "but Kodak is putting a lot of marketing behind the idea of multisession, and the public perception will be that multisession is important." As a result, virtually all major manufacturers will be adding multisession capability to their new drives. Usually it requires a patch to the drive's firmware, plus some modifications to the servo tracking system so the device knows what to do when the laser pickup stumbles on an unrecorded region of the disc. Such modifications add little or nothing to the retail price of a CD-ROM drive.

If you opt for a dual-speed drive, though, you will pay a premium. NEC introduced this feature in 1992, and it's catching on fast. To see why, compare the specifications: A typical single-speed drive might have an average seek time of 450 milliseconds and a data transfer rate of 150 Kbps. A dual-speed drive's numbers might be 280 ms and 300 Kbps. Such performance is still anemic by hard drive standards, but it makes a big difference when you're reading high-resolution Photo CD images, which can run to 6 MB in size. The next frontier is likely to be 600-Kbps "quadspeed" drives like Pioneer's new DRM-604X.

Here's the bottom line. If you need a CD-ROM drive to access static information—encyclopedias, technical manuals, reference books, and so on—you can get by with an inexpensive single-speed drive without XA or multisession support. For multimedia CD-ROM applications involving sound and animation, consider a dual-speed drive for best throughput. If you anticipate using Photo CD at all, you'll need at least an XA-ready single-session drive. For serious Photo CD work, settle for nothing less than a dual-speed drive with full XA and multisession capability.

Tom Halfhill is BYTE's senior news editor in San Francisco. You can reach him on BIX as "thalfhill."

drive to build custom CD-ROMs for its Unix clientele. For each disc, SAS selects an appropriate subset of programs from its large family of products and uniquely serializes the programs to copy-protect them.

The U.S. Geological Survey (Reston, VA) has used CD-R since 1989. To equip its field offices, a $60,000 Meridian solution that uses a Yamaha drive "was just too rich for the taxpayers' pocketbook," says Dave Traudt, manager of the USGS CD-ROM support center. Traudt placed low-cost CD-R drives in seven field offices and is buying four more. "Our agency has a very tight budget; that should tell you a lot about how we see recordable technology," he notes.

CD-R has been available to businesses flush with cash for several years. Now, affordable CD-R from Philips (the $7995 CDD 521), Sony (the CD-900W, not sold at retail), JVC (the $12,799 Personal RomMaker and $9995 Personal Archiver), and Pinnacle Micro (the $4995 RCD 202) have put the technology within reach of a vast new segment of users (see the text box "Affordable CD-R Drives" on page 118).

One Drive Reads All

Without CD-R, CD-ROM mastering and replication require that the data, usually on 9-track tape or DAT (digital audiotape), be sent to an outside duplicator that uses the same multimillion-dollar equipment that stamps out audio CDs. The new recordable drives produce an equivalent product—CD-ROM discs containing files in the standard ISO 9660 format that ordinary CD-ROM players can read (see the text box "Buying a CD-ROM Drive" above). But CD-R (or CD Write-Once) discs aren't replicated from a master. Each is a custom edition that is made by copying data from a

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Circle 120 on Inquiry Card.

hard disk to a specially made blank disc.

The CD-R drive's high-powered laser burns pits into a pregrooved 120-millimeter disc that is a sandwich of polycarbonate substrate, organic dye, and a gold reflective layer (see figures 1 and 2). The half-hour or hour required for this transfer and the $25 to $40 cost of the blank dictate that CD-R will complement rather than replace mastering and replication.

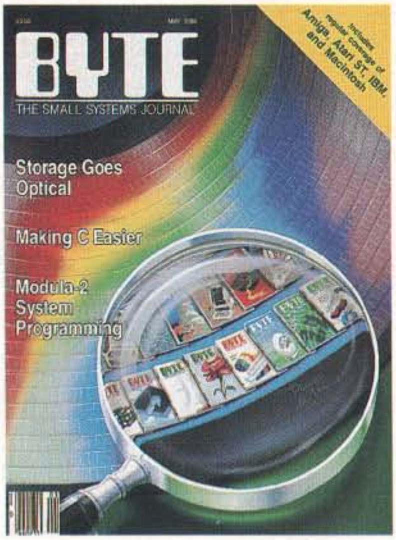
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Photo 1: *BYTE touted the promise of CD-ROM to revolutionize publishing on the cover of our May 1986 issue. Today, CD-R appears poised to deliver on that promise.*

Popular Publishing

All organizations collect and disseminate information. Several innovative ones now publish their parts catalogs, training manuals, technical documentation, and other forms of mission-critical data on CD-ROM. A CD-ROM disc is not only infinitely smaller, lighter, and cheaper to transmit than the equivalent tower of 200 Webster's dictionaries, but is also far more useful, because it is electronically searchable.

By lowering the barrier to entry, CD-R will dramatically expand the number of CD-ROM publishers and applications. Companies that produce discs using CD-R have to worry about the same duplication economics as before, to a point. Depending on the cost of the CD-R media, the break-even point for making copies using CD-R is between 20 and 100 discs. Above that, conventional replication will be cheaper (see figure 3 on page 131). In some cases, factors that aren't purely economic (e.g., convenience or security) could push the ball into CD-R's court.

While reviewing the CDD 521 Philips drive (see "Desktop CD-ROM Publishing," January BYTE), I built a prototype of a disc containing BYTE's text from the last six years—a possibility suggested by the BYTE cover story on CD-ROM in the May 1986 issue (see photo 1). (The project had long been contemplated as a tool for editorial research.) The recordable drive made the project feasible, and being able to demonstrate a real CD-ROM disc galvanized support as nothing else could have.

I doubt that our situation is unique. CD-R's advent will spur countless fence-sitters to action. Says Larry Schiller, president and CEO of the Bureau of Electronic Publishing, a CD-ROM distributor (Parsippany, NJ), "Just about every business with sales of $10 million or more will buy a recording drive."

Internal disc production has security benefits, too. Military, government, or corporate users who must publish highly sensitive information on CD-ROM may not want to release that data, even temporarily, to an outside mastering facility. With a secure in-house CD-R system, the secrets can be safely reproduced.

continued

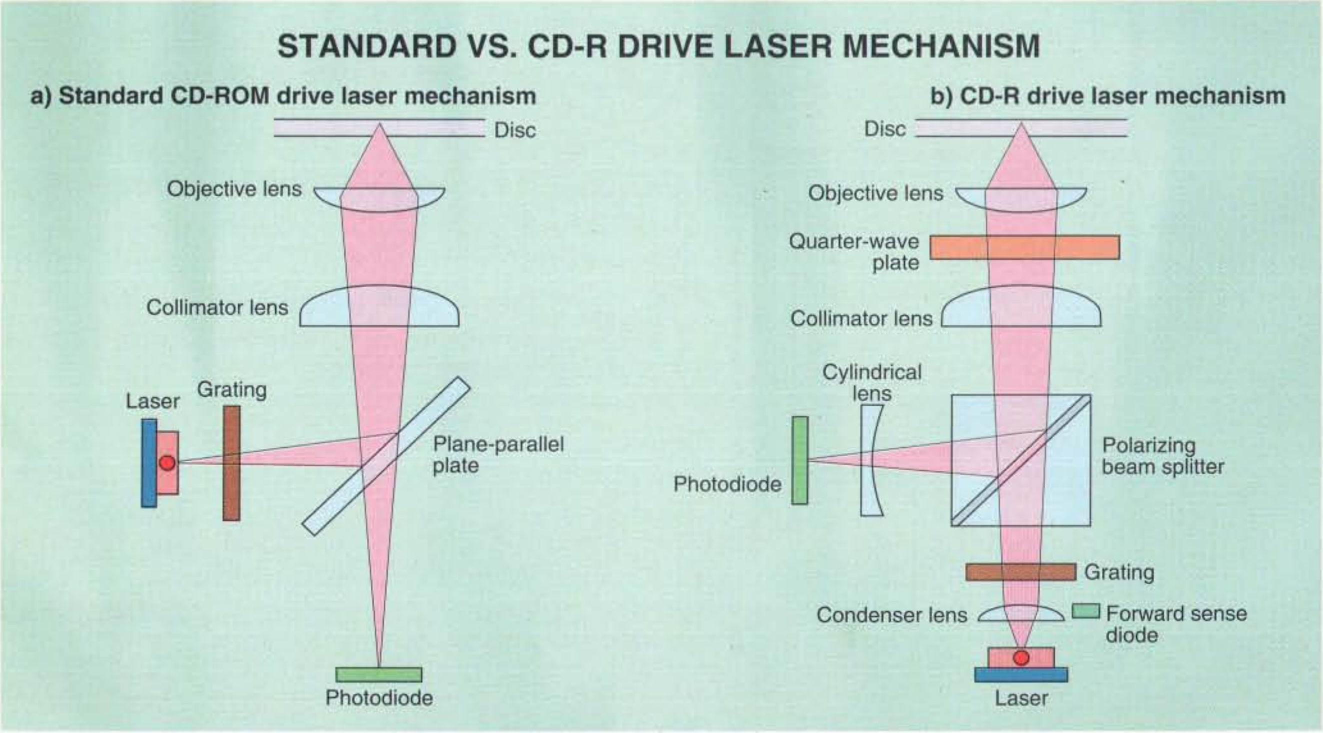

Figure 1: (a) *In a standard CD-ROM drive, the laser's orientation is perpendicular. The beam takes a 90-degree bend en route to the disc and then reflects back to the photodiode.* **(b)** *In a CD-R drive, the path from laser to disc runs straight. The condenser lens couples the light to improve the laser's output, and the forward sense diode measures its intensity. The quarter-wave plate rotates the beam's polarizing direction twice, so the reflected light takes a 90-degree bend on its way to the photodiode. (Figures courtesy of Philips Consumer Electronics Co.)*

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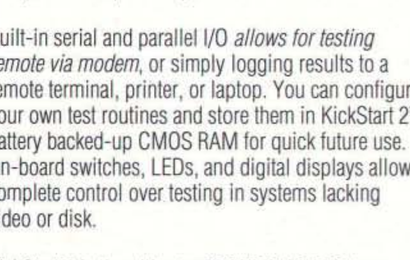

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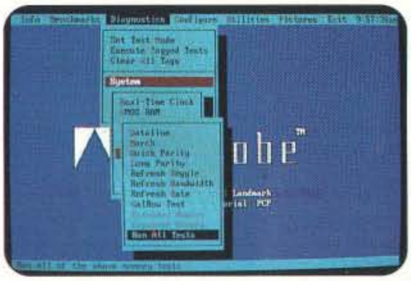

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Circle 136 on Inquiry Card (RESELLERS: 137).

The New Breed of CD Players

ED PERRATORE

Three unusual CD players debuted in 1992: Sony's MMCD Player, Tandy's VIS (Video Information System), and Philips' CDI 360 Portable. Each uses a different processor, operating system, and CD format (see the table). The common threads are CD-ROM and NTSC output. These three specialized CD appliances are all equipped to play on your TV.

The VIS, restricted to that mode, most clearly targets the home market. VIS applications use a Windows derivative called Modular Windows, which presents a simplified interface on a TV screen and takes user input from an infrared remote control. Developers will use familiar Windows tools to create VIS applications and can readily port MPC titles to the new platform. Owl International (Bellevue, WA) and AimTech (Nashua, NH) have announced authoring tools to support the VIS.

Initially, the VIS CD-ROM drive supports neither single-session nor multisession Photo CD. However, the VIS is eminently upgradable, with sockets for a video accelerator and a modem. "It's the most open-architecture computer out there," says Richard Doherty, editor in chief of the multimedia newsletter *Envisioneering* (Seaford, NY), "but Tandy will say, No! No! It's not a computer, it's an appliance!"

The Sony and Philips players, which can connect to a TV or run stand-alone, double as entertainment or educational appliances and as business tools. *Newsweek*'s recently announced *Newsweek Interactive*, a quarterly CD-ROM version of the magazine, will showcase the MMCD Player as a home entertainment device. Northern Telecom's new diagnostic application for PBX systems will put the MMCD Player to work. The company's 3700 field technicians will soon be able to connect the Sony unit's serial port to PBX switches, run diagnostic software, and hotkey to a 30,000-page store of searchable documentation.

Philips' CDI 360 can also play in both consumer and business markets. The company is marketing CD-I as a better platform than CD-ROM XA for integration of audio, video, text, and graphics. An alliance between Dataware Technologies and Philips subsidiary OptImage brings the data-crunching capability of traditional CD-ROM retrieval software to the sight-and-sound world of CD-I.

Although the MMCD Player's use of the CD-ROM XA format theoretically enables it to share titles with ordinary PCs that have XA drives, there are obstacles. Most XA drives sold today don't come with the hardware support (ADPCM [Adaptive Differential Pulse Code Modulation] decompression and deinterleaving) that Sony's embedded XA chip set provides. Also, the Sony unit's small display and lack of a hard drive make it incompatible with current XA-based PC applications.

For Philips, the cost of CD-I hardware and development tools is an impediment, as is the royalty the company charges for use of the CD-I name. "When you say 'CD-I,' you are mentally writing a check to Eindhoven [the Netherlands base of Philips Electronics NV]," says Doherty, "and that rubs a lot of people the wrong way."

CD-ROM DRIVES FOR YOUR TV

The VIS, with no display of its own, allows output options to near-VGA 640- by 400-pixel and lower resolutions in addition to NTSC. Part of the CDI 360's price is for a 6-inch active-matrix color display unmatched by the MMCD. (N/A = not applicable.)

	CDI 360	MMCD	VIS
Processor	68000	8086	286
Operating system	OS/9	DOS	Modular Windows
Disc format	CD-I	CD-ROM XA	CD-ROM
RAM	8 KB nonvolume	640 KB	1 MB
Attached display	Yes	Yes	No
Serial port	Yes	Yes	No
Display resolution (pixels)	756 × 556	300 × 200	N/A
Compressed audio in hardware	Yes	Yes	No
Full-motion video in hardware	Available first quarter 1993	No	No
NTSC output	Yes	Yes	Yes
PAL output	Yes	No	No
Portable	Yes	Yes	No
Price	$2000	$1000	$700

Ed Perratore is a BYTE news editor based in New York. You can reach him on BIX as "eperratore."

One-of-a-kind discs could also be useful business development and sales tools, says Rich Bowers, executive director of the OPA (Optical Publishing Association) (Columbus, OH). Each year, 100,000 companies bid to sell their wares to the U.S. government, and a response to a federal request for proposals can run to hundreds of pages. Similarly, pharmaceutical companies require heaps of documentation to obtain FDA approval for new drugs. Submitting the required 20 copies of your proposal on CD-ROM, says Bowers, is easier for you to send and for the recipient to evaluate. CD-ROM also gives you the option of making a more

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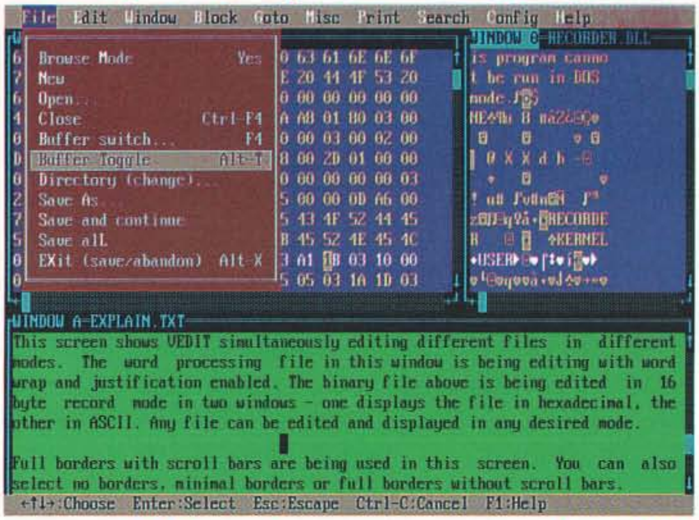

```
0 63 61 6E 6E 6F   is program canno
E 20 44 4F 53 20   t be run in DOS
0 00 00 00 00 00   mode.
A A8 01 B0 03 00
0 00 03 00 02 00
8 00 2D 01 00 00
0 00 00 00 00 03
5 00 00 0D A6 00
5 43 4F 52 44 45   RECORDE
B 45 52 4E 45 4C   KERNEL
3 A1 0B 03 10 00   USER
5 05 03 1A 1D 03
```

```
This screen shows VEDIT simultaneously editing different files  in  different
modes.  The  word  processing  file in this window is being editing with word
wrap and justification enabled. The binary file above is being edited  in  16
byte  record  mode in two windows - one displays the file in hexadecimal, the
other in ASCII. Any file can be edited and displayed in any desired mode.

Full borders with scroll bars are being used in this  screen.  You  can  also
select no borders, minimal borders or full borders without scroll bars.
```

Until now, data files, such as database files, downloaded mainframe files, Postscript and plotter output, .EXE executables and other non-standard files were a real headache if you ever had to view, patch, search, search/replace or extensively edit them.

Traditional text editors can't handle these files because they are non-standard or too big. Traditional disk utilities allow only the most primitive viewing and patching. Just a single corrupted data file could take days to fix, and you sweated and cursed the whole time.

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VEDIT lets you edit data files as effortlessly as text files. Its secret is incredible speed, huge file capacity and special editing modes.

File modes support DOS, Unix and Mac style text files plus data files with fixed length or variable length records. Display modes include five ASCII modes, Hexadecimal and EBCDIC, or split the screen for any combination. Search using pattern matching or regular expressions, cut and paste data files, and much more. Long lines can be horizontally scrolled or wrapped onto multiple screen lines.

Handle nasty "text" files too

Text files may sound easy to edit, but other editors choke when they hit embedded control (null) characters, very long lines or the 400 Megabyte file you are trying to put onto a CD-ROM. VEDIT handles all text files effortlessly and automatically detects the correct file type. With VEDIT you can conveniently edit any file you will ever encounter.

Speed, speed, speed

Only VEDIT has the speed to edit multi-megabyte files. Traditional text editors such as Brief(tm) and Sage(tm) are much too slow to edit files much larger than memory; and Multi-Edit(tm) is 7 times slower than VEDIT. And none of them can efficiently edit data files.

	VEDIT	Brief	Multi-Edit	Sage
Edit data/binary files	Yes	No	Some	Some
Support fixed-length records	Yes	No	No	No
Maximum line length	Unlimited	512	2048	65K
Maximum file size	2000 Meg	32 Meg	32 Meg	100 Meg
Hex/EBCDIC editing	Yes/Yes	No/No	No/No	No/No
Multiple display modes	Yes	No	No	No
Fast browse of CD-ROM	Yes	No	No	No
Global search/replace in 10 Meg file	2:49 min	>24hours	20.0 min	2:10 hour

Ultimate programmer's editor

Long a favorite among programmers, VEDIT has every advanced feature you might expect. Simultaneously edit numerous files, split the screen into windows, search/replace with regular expressions. Automatic indent, block indent, parentheses matching and block operations by character, line, file or column speed program development. Word wrap, paragraph formatting, justification, centering and many printing options are ideal for text processing.

Its unique compiler support integrates tools from different vendors and fully supports "make". VEDIT PLUS has the most powerful macro programming language of any editor. It's ideal for translating files from one format to another.

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An intuitive user interface with drop down menus, hot keys, mouse support, optional scroll bars, context sensitive help, point and shoot file selection and unlimited keystroke macros make VEDIT PLUS easy to use, easy to learn. Safety features include 1000 level undo, auto-save and optional backup files.

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CD-ROM title

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2. Microsoft Bookshelf
3. CD-Music
4. Sherlock Holmes
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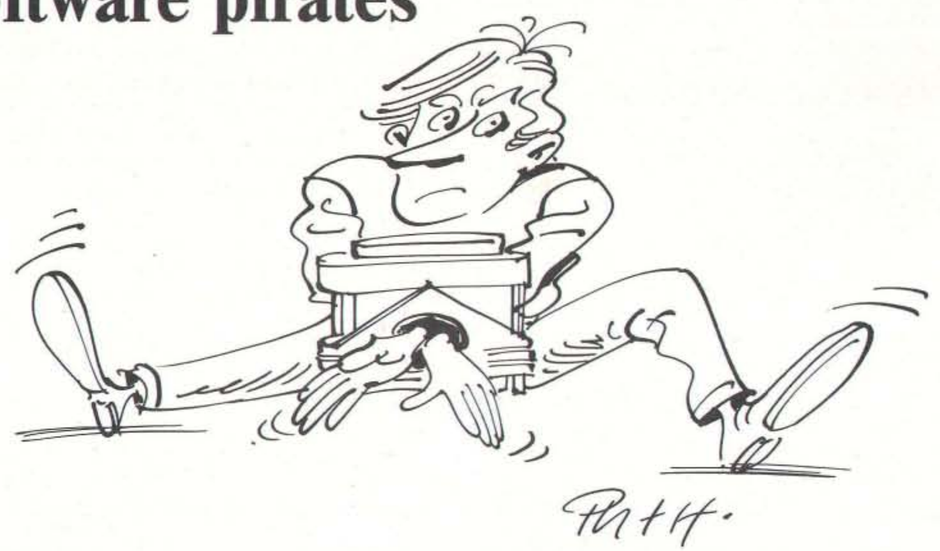

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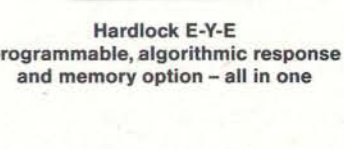

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Circle 412 on Inquiry Card.

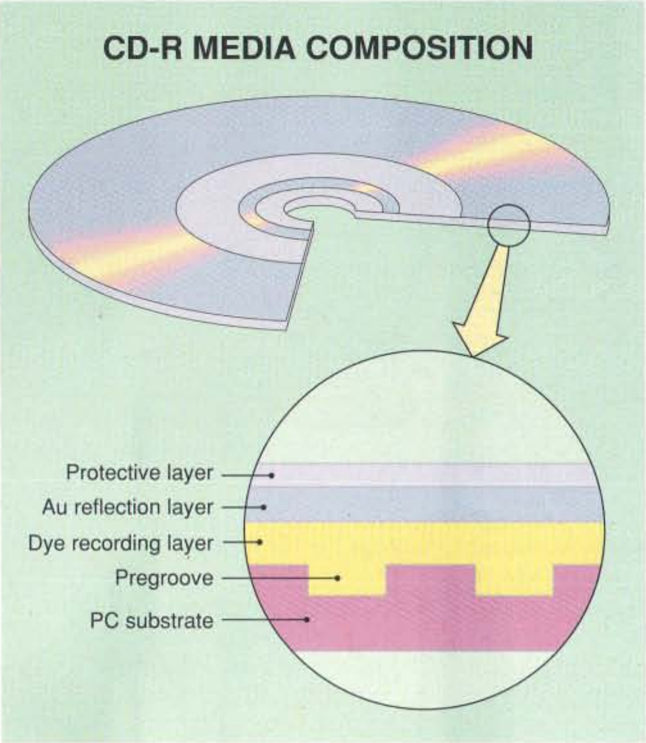

Figure 2: *The CD-R media consist of four layers: the top protective layer, the gold (Au) reflection layer, the dye recording layer, and the PC substrate. The CD-R laser heats the reflection, recording, and substrate layers. As a result, the recording layer fuses and is impressed by the expanding substrate layer. (Figure courtesy of Philips Consumer Electronics Co.)*

impressive sales pitch by jazzing up the content with sound and video.

For governments, a compelling use of CD-R will be to satisfy requests for information. Conventional CD-ROM publishing has already improved matters tremendously. Topographical and geological survey data used to cost $100 per 9-track tape. Now you can get it on CD-ROM for $32, says George Knapp, a USGS abstracts editor and chairman of SIGSOFT, a group that evaluates CD-ROM authoring and retrieval tools. "For public access to data," he says, "CD-ROM is the greatest thing that's ever happened."

The Office of Business Analysis in the U.S. Department of Commerce (Washington, DC) publishes the National Trade Data Bank on a CD-ROM that amalgamates import/export data, marketing studies, and foreign-aid program information from 15 federal agencies. The disc helps U.S. exporters understand international markets. A second title that delivers U.S. economic, social, and environmental data will soon be available.

CD-ROM discs produced under federal auspices are almost always replicated, even if they're ultimately sold only in small numbers, because copies must be distributed to the federal depository libraries—a group of some 1250 university and public libraries that agree to store federal data issued through the U.S. Government Printing Office. Nevertheless, there is a need to publish individual discs on demand.

Daniel Costanzo, a physical scientist with the U.S. Army Topographic Engineering Center (Ft. Belvoir, VA), expects that customized slices of topographical data that today ship on 9-track tape will eventually be delivered on CD-ROM discs. There's also an argument in favor of publishing some kinds of widely distributed data on demand. "If you print 10,000 CDs of GIS [geographic information system] data, it's like printing 10,000 maps," he says; "the currency deteriorates over time." In cases where demand-published CDs are feasible, users will always get fresh data.

The nature of that data will determine how well such a model works. Satellite and sonar images, which are just collections of files, are easy to dump to a disc. In the case of text or fielded data, however, the need to index the material will make it harder to carve out and deliver unique subsets.

Publisher Profiles

For CD-ROM publishers, testing discs prior to mass production was a complex ritual before CD-R. An emulator like Meridian's CD Publisher could make a hard disk–based ISO 9660 "image" written by an authoring tool look like a CD-ROM to the retrieval software. Such emulators can artificially slow access to the hard disk to help you gauge what the actual CD-ROM performance will be.

But one person sitting at the emulator's console can't fully explore the vastness of a disc and ensure that hundreds of megabytes of data have been properly assembled. For that, you need to make discs that can be distributed to a team of testers equipped with ordinary, inexpensive players. Suppose you need 10 such discs. Producing them by conventional means might entail a minimum order of 100, cost $1500, and take three to five days. The CD-R solution, by contrast, yields just the 10 discs you need, for about $300, in one day. "After you've gone around that track a few times," says Bill Harlow, a marketing manager at Philips Consumer Electronics (Knoxville, TN), "our drive has already paid for itself." On a tight deadline, the rapid turnaround of CD-R—for which mastering houses may double their fees—can be a critical factor.

The number of CD-ROM publishers is growing rapidly. Market researcher InfoTech (Woodstock, VT), which has tracked the CD-ROM industry since its inception, reports that last year the number of commercial and in-house titles grew from 3500 to 5000, and the installed base of drives more than doubled, to over 5 million (see figure 4 on page 132). At the same time, the CD-ROM retail market experienced dramatic change, according to the Bureau of Electronic Publishing. In 1991, fewer than 20 percent of the 17,000 computer-related retail outlets in the U.S. carried CD-ROM products. Last year, 80 percent did.

The Library Corp. (Inwood, WV) helps public and university libraries merge their own collections data with general sources such as indexes of periodicals, thereby creating custom titles unique to each library. Conventional replication is the technique of choice for bigger customers, such as the St. Louis Public Library, which has 141 networked readers. But CD-R is The Library Corp.'s ace in the hole for clients like Texas Christian University, which needs only a single disc.

Donnelly Marketing Information Services (Stamford, CT) makes CD-ROMs for market researchers. DMIS's director of software development, Mike Herman, says his company is investigating ways to create "onesie-twosie" discs for clients who want to merge their own data with the DMIS data. For Herman, the human cost of producing custom discs is by far the biggest issue.

At Hub Data (Cambridge, MA), a publisher of financial data on CD-ROM, CEO Bob Huebscher views CD-R as a way to deliver incremental updates to his monthly product. Huebscher sees the cost of CD-R blanks as a bigger obstacle. "I wouldn't think twice about a $2 disc," he says, "and I'd consider $10, but the current

PageMaker 4.0
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Once and Future Standards

A flurry of emerging standards swirls around CD-ROM and CD-R. For starters, there's a new "color book" on the horizon. The Crayola box of CD standards (see figure A) has for some years included Red Book (CD audio), Yellow Book (CD-ROM), and Green Book (CD-I). (CD-ROM XA doesn't rate its own color; it works within Yellow Book's free-form mode 2 sectors.) Now there's Orange Book, which governs MO (magneto-optical) and CD-R drives. Part 1 of Orange Book defines a CD-ROM/MO hybrid. Part 2 defines single-session and multisession CD-R, and it is the subject of much current confusion.

Because the specification isn't nailed down, true Orange Book devices don't exist yet. Among CD-R drives, the Philips CDD 521 follows Orange Book most closely, although Philips admits a drive bought today might need a firmware upgrade next year. Sony has chosen to wait for a final specification before building multisession support into its CDW-900E. Alan Sund, Sony's (San Jose, CA) marketing manager for CD-ROM drives, says, "We're not going to have a compromised product claiming to follow a standard that doesn't yet exist."

Meanwhile, vendors of CD-ROM players—including Pioneer, Toshiba, Philips, and, yes, Sony—are scrambling to make their drives work with multisession Photo CD discs. Kodak, too, is betting that its own Photo CD player won't become obsolete by some last-minute change in the specification.

Why the confusion over multisession CD? Early developers of CD-ROM never anticipated CD-R. Users would read CD-ROMs, not write them, and a single session that could hold oceans of data hardly seemed limiting. (In retrospect, the handwriting was on the wall. From the beginning there were "mixed-mode" discs that combined file-system data and audio tracks.)

Those same assumptions led to the ISO 9660 file system, which is both a great strength of CD-ROM and an increasingly troublesome limitation. ISO 9660's strength lies in its unique status as an operating-system-independent file system. An ISO 9660–formatted disc works identically on a PC, a Mac, or a Sun workstation. The disc may include operating-system-specific versions of a retrieval application, but each of these will access a common set of files. However, ISO 9660 is a least-common-denominator file system: It sacrifices features of the Mac (e.g., icons and resource forks) and Unix (e.g., symbolic links and permissions), and it doesn't permit updates.

There are two ways to make richer CD-ROM file systems. One is to make a non–ISO 9660 CD that uses a native Macintosh or Unix file system. That works, but performance can suffer since these file systems require special tuning for slow media. Also, you lose the vaunted interoperability of CD-ROM.

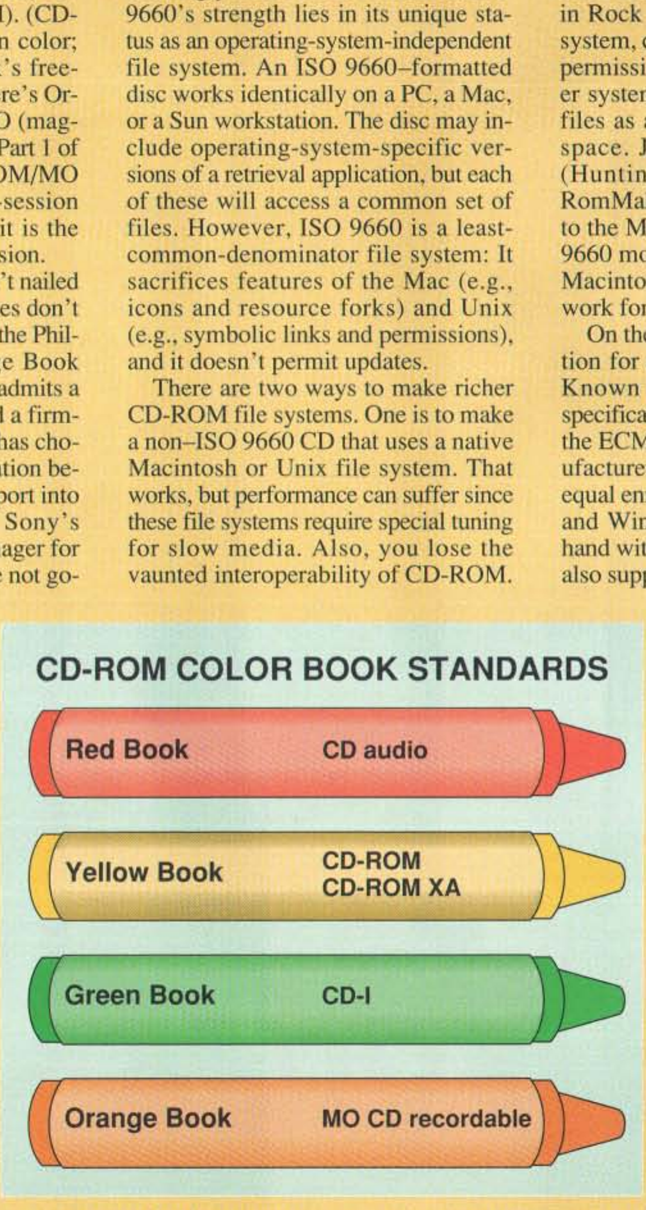

Figure A: *CD-ROM standard specifications are categorized by color. The new color is Orange, which covers MO and CD-R.*

A second approach is to wrap operating-system-specific extensions around an ISO 9660 core. The Unix version of this technique is the Rock Ridge protocol, a compatible superset of ISO 9660. Unix systems equipped with the Rock Ridge extensions see a CD-ROM in Rock Ridge format as a Posix file system, complete with long filenames, permissions, and symbolic links. Other systems see the same collection of files as an ordinary ISO 9660 namespace. JVC Information Products' (Huntington Beach, CA) Personal RomMaker applies the same concept to the Macintosh. Its hybrid HFS/ISO 9660 mode makes discs that look like Macintosh volumes to Mac users but work for DOS and Unix users as well.

On the drawing board is a specification for a new CD-ROM file system. Known informally as the Frankfurt specification (officially, standard 168 of the ECMA [European Computer Manufacturers' Association]), it promises equal enrichment for Unix, Mac, OS/2, and Windows NT. Working hand-in-hand with Orange Book, Frankfurt will also support the incremental update capability that ISO 9660's designers never thought would be needed. The Orange Book/Frankfurt combination promises to make tomorrow's CD-R systems as easy to update as today's WORMs, while elevating the cross-platform CD-ROM standard to meet the needs of modern operating systems.

The catch? Everything breaks. Drives will need firmware upgrades, and no current CD-ROM software infrastructure will carry over to Frankfurt discs. That's why Young Minds' (Redlands, CA) president Andrew Young says of the Rock Ridge extensions he invented: "We're solving a today problem. Frankfurt solves a tomorrow problem."

$25 just isn't in the ballpark." The frequency of publication combined with high media cost would shrink Hub Data's profit margins.

Not much can be done about the labor cost of CD-R production, although some drives (e.g., Sony's) can be used in parallel to produce multiple copies at a time. Media costs are falling, however; the only questions are how far and how fast. Eastman Kodak (Rochester, NY) predicts $10 blanks in a few years. Is that likely? Much depends on the success of Kodak's Photo CD, a new imaging process that is the granddaddy of all CD-R applications. (Kodak writes Photo CD discs using the Philips CDD 521 drive.) Photo CD could be the engine that drives CD-R, just as audio CD powered CD-ROM. Moving just 1 percent of the film images processed each year into Photo CD format would create 5 million custom discs.

CD-ROM has also become a popular vehicle for software distribution. "We don't have final numbers yet," says InfoTech researcher Deborah Barlow, "but I won't be surprised if the number of discs used for software delivery exceeds those published for sale as commercial titles." Sun Microsystems, Hewlett-Packard, and Apple have long used CD-ROM to deliver software, but this year has seen many new entrants, including IBM (OS/2), Microsoft (Windows NT), and Borland International (Borland C++). Windows NT alone, still in prerelease, has already shipped on CD-ROM to 20,000 software developers.

The U.S. government is keeping pace with this trend as well. Allan Betts, CD-ROM production chief at the National Technical Information Service (Springfield, VA), says that the U.S. government produced 2000 titles last year, and he predicts rapid future growth. Betts, who advises dozens of federal agencies on CD-ROM production, says that one of the pressing plants his clients use now gets more than half its input in the form of CD-R discs rather than the traditional magnetic tapes.

Another segment builds multimedia titles for MPC, CD-ROM XA (Extended Architecture), and CD-I (Compact Disc Interactive) platforms (see the text box "The New Breed of CD Players" on page 124). The authoring tools these publishers use differ from the ones that create conventional titles, especially when the target is an XA or CD-I player that expects a mode 2 format incompatible with the mode 1 format of conventional CD-ROM (see the text box "Once and Future Standards" on page 130). But these distinctions exist purely at the logical level. To a CD-R drive, it's all just bits. Users of Mammoth Micro Productions' (Golden, CO) Studio/XA or OptImage's (West Des Moines, IA) MediaMogul test their XA and CD-I titles on the same CD-R drives that Dataware Technologies (Cambridge, MA) or SilverPlatter (Norwood, MA) customers use to develop standard CD-ROMs.

Manage Your Assets

As CD-ROM technology grows more practical, companies often find that they're unprepared to meet the challenge of what the OPA's Bowers calls "enterprise publishing." According to Bowers, CD-ROM has catalyzed a whole new view of the corporate information asset. "When you shift to this view," he says, "you suddenly find your whole structure [the way corporate data is stored] is upside down." Text kept in a random assortment of formats, tagged haphazardly or not at all, won't easily flow into a structured, possibly hyperlinked CD-ROM application.

Vendors of authoring and retrieval tools—including Fulcrum, Verity, and Personal Library Software—use fuzzy search and relevancy techniques, as opposed to standard Boolean searches, to minimize the need for structure. Fuzzy searches look for an approximate match; for example, a search for the word *war* might also turn up references to *conflict* or *battle*. Relevancy examines the context of the retrieved text to determine the most appropriate hits.

Such products also support fields, however. Structure married to sophisticated full-text search capability is the most powerful combination. Electronic Book Technologies' (Providence, RI) DynaText exploits that combination in a striking way: When you do a search, it distributes the hits across the table of contents, so you can see at a glance which are the relevant chapters or sections. Thus, instead of getting hits on a per-document basis, you see how they relate to structure internal to documents.

How do you put in the structure? A consensus is rapidly emerging: SGML (Standard Generalized Markup Language). SGML is an extensible system for describing the structure and style of richly formatted documents (see "SGML Frees Information," June 1992 BYTE). Like many government-mandated standards, it bores the average person to tears. However, it is clearly the right way to manage text for dual use—that is, for simultaneous print and electronic publication. That's why both Novell and Silicon Graphics recently decided to migrate their documentation from proprietary formats to SGML. Avalanche Development (Boulder, CO) and Exoterica (Ottawa, Ontario, Canada) offer SGML conversion tools. Dataware Technologies' CD Hypertext, which natively comprehends SGML, is an authoring tool that the company used to build a hyperlinked CD-ROM version of the U.S. tax code.

Another strategy for text is Adobe's Acrobat. Acrobat builds on two core technologies: Adobe's Multiple Master fonts, which can emulate the metrics of virtually any font, and a "reduced instruction set" PostScript that compresses files to a fraction of their normal size. The architecture includes a file standard, known as PDF (Portable Document Format), and software to convert

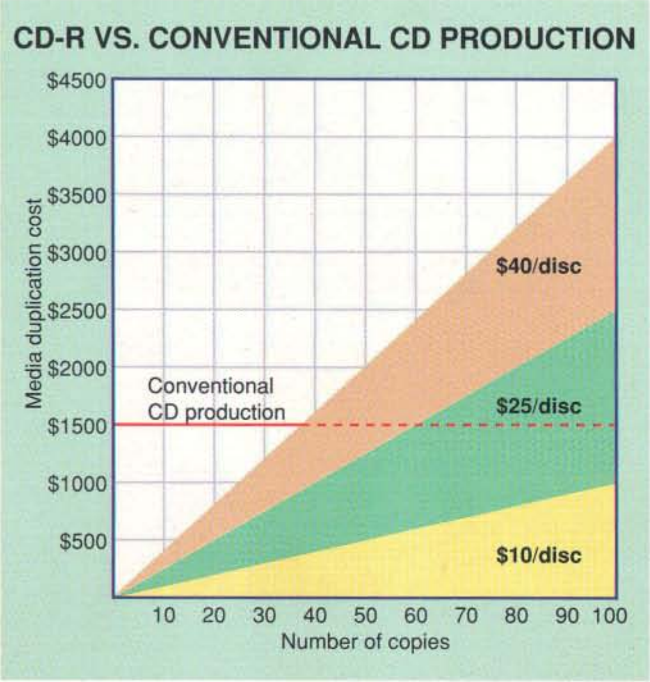

Figure 3: *CD-R production pays as long as the number of copies stays relatively low. Conventional CD-ROM duplicators charge about $1500 for 100 discs; that rate can double for one-day turnaround. At $40 per disc, CD-R is cost effective for press runs of under 35. This chart does not take into account the cost of the CD-R drive or the cost of labor.*

PostScript and non-PostScript documents into PDF format. Inexpensive software viewers that allow you to read and navigate PDF documents will be supplied first for Windows PCs and Macs and later for Unix, DOS, and OS/2 systems.

Using Acrobat, you can assemble documents created in a desktop publishing program such as PageMaker and run them through a batch Distiller that converts them to PDFs. Or you can use the PDF Writer to convert non-PostScript word processing files from Word or WordPerfect. Once these documents are written to a CD-ROM or other distribution medium, any system that hosts a viewer application can read them. In fact, viewers customized to read only the documents on a given CD-ROM can even be shipped with each disk. Note, though, that the first release of Acrobat won't support full text indexing.

The correct dual-use strategy for nontextual data is far less obvious. You can't just dump a Clipper or FoxPro application onto a CD-ROM disc and expect anything close to reasonable performance against large data sets. While the newer CD players can transfer data at a respectable clip, their slow seek times relative to those of hard disks remain a deadly impediment. Commercial tools like Dataware's CD Author use a variety of tricks to optimize for CD-ROM: loading B-trees fully (since they can't grow in a read-only environment), storing indexes as separate files, and exploiting disc geography for best locality of reference. With these techniques, a simple search can take just seconds instead of many minutes.

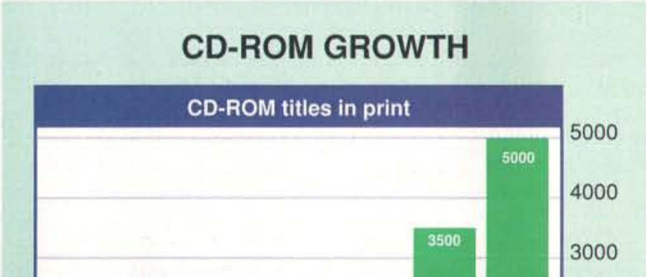

Figure 4: *The global rate of growth in both the installed base of CD titles in print (top) and players (bottom) since the inception of CD-ROM technology has been significant and steady. The numbers shown here, courtesy of InfoTech, represent both commercial and in-house units. Note that InfoTech's more conservative accounting treats data sets that may span many discs as single titles.*

Complex queries present even trickier problems, however. A SQL query that wanders all over the disc will take a year and a day, and it has no place to write its temporary indexes. Many producers of CD-ROM database products take a radically asymmetrical approach: They anticipate common queries, generate result sets in advance (often represented as bit maps), and write the prepared results to the disc alongside the data. Such preparation, which can take days of processing, gives users the illusion that their queries run almost instantly. Unfortunately, there's no simple or automatic way to convert a live transactional database into an optimized CD-ROM database.

Publishing for Posterity

CD-R clearly threatens WORM as an archival medium, although in the short run WORM's chief competitor will be MO (magneto-optical) technology (see the text box "Optical Flavors" on page 134). CD-R's compelling advantage is that you can read an archived disc in any CD-ROM player.

Creating that disc is complicated by three factors, however. First, you've got to translate the source file system (DOS, Mac, or Unix) into the neutral ISO 9660 file system that is the CD-ROM standard. Drives often provide formatters that convert on the fly as they write to the disc, but they may not handle some subtle naming conflicts. Hyphens are legal in DOS, for example, but not in ISO 9660.

Second, you must feed the drive a continuous stream of data. A dual-speed recorder, which fills a disc in a half-hour, needs a sustained 300 Kbps. That's only achievable from a fast hard disk in a controlled environment. Archiving a network drive must therefore be a two-stage process—one transfer to the CD-R workstation's hard disk, and then another to the CD-R drive. Finally, you'll want enough data on hand to justify the use of an expensive piece of media that can hold upward of 600 MB. Most CD-R drives don't yet support append operations (i.e., multisession recording), and none allow incremental file-oriented updates.

Other issues are the quality and longevity of CD-R media. NTIS's Betts found a distressing number of uncorrectable errors in early batches of CD-R discs he tested. Admittedly, Betts uses Enterprise Corporation of America's (West Des Moines, IA) CD-CATS (CD computer-aided testing system) to ferret out tiny defects that might well escape the notice of casual users. Still, "if Reed-Solomon [CD-ROM's error correction code] won't read," he says, "it is by definition not a CD-ROM." The CD-ROM specification requires functional error correction. Betts adds that the situation is improving rapidly.

Longevity is an open question for both CD-ROM and CD-R media. Since CD-R discs are burned, not pressed, they are more vulnerable to heat. Manufacturers also warn users to handle CD-R discs with greater care than CD-ROMs, implying that they're more fragile. But assuming that you take reasonable precautions with regard to heat and handling, there's no reason to think CD-R discs won't endure for 10 years, 25 years, or longer. It's even possible they'll outlast CD-ROMs, says Digipress (Louisville, KY) general manager Denis Oudard, an expert in archival CD-ROM. (His company's Century-Disc, a specialized $495 CD-ROM made of tempered glass, aims to last hundreds of years.) "The Achilles' heel of conventional CD-ROM is the aluminum reflective layer," says Oudard; it oxidizes too easily. CD-R discs use gold, which is more stable.

You don't have to own a CD-R drive to archive your data onto a CD-ROM. If it's something you'll need to do only once, you can

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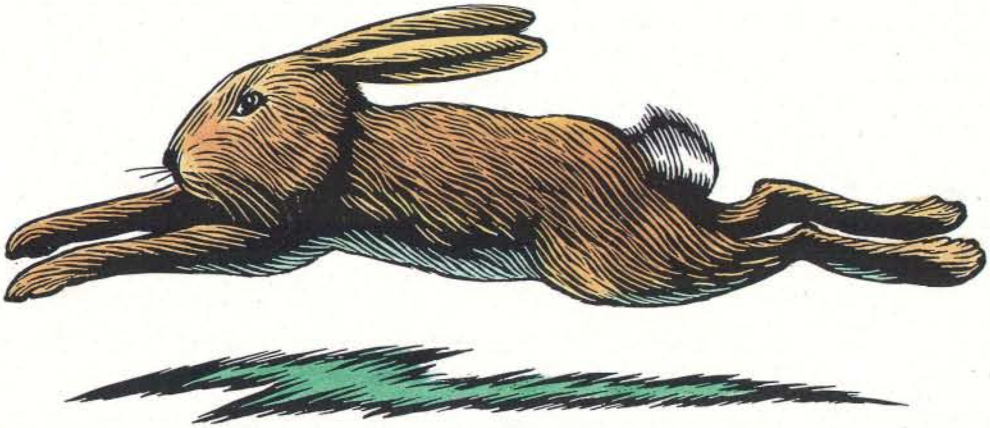

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CD-R offers a mix of drawbacks and advantages relative to its optical competitors WORM and MO (magneto-optical). With incremental, file-oriented write capability still on the drawing board for CD-R, it loses out to MO and WORM for interactive on-line use. It also loses out on price, with an average drive costing just under $10,000. WORM drives average $3800, while MO drives average roughly $4500. CD-R's great strength is standardization unmatched by any other form of removable media. Magnetic options such as Bernoulli and Syquest are proprietary, and the WORM market has been plagued by noninterchangeability. CD-R users can rest secure in the knowledge that archived data will be readable on any CD-ROM player.

In the short term, however, it's MO rather than CD-R that is usurping WORM's archival role. Researcher Freeman Associates' (Santa Barbara, CA) vice president Robert Abraham projects that sales of 5¼-inch WORM drives will plunge from 40,000 units this year to almost none in 1997, while 5¼-inch MO drives will grow from 174,000 to 400,000 units over the same period.

Competition for WORM will come from two kinds of "multifunction" MO drives. Hewlett-Packard, Sony, Hitachi, and Maxoptix sell drives that use standard 5¼-inch MO media but allow users to designate certain disks for write-once use only.

Critics charge that by merely emulating WORM, these drives don't offer the same degree of permanence and security as true WORM. Abraham says some people insist on using only ablative media that record permanently. Responding to that need, Pioneer and Laser Magnetic Storage sell drives that accept the same write-once media as their traditional WORM drives and also read and write 5¼-inch MO disks. Abraham says these drives are a good option for users who insist on true WORM but sometimes want the flexibility of rewritable media.

As CD-R drives and media get cheaper, recordable CD technology is likely to capture a growing share of the archival market. Early applications will have to be batch-oriented, however. "When you write to a CD," says Cris Simpson, an optical memory engineer with Pioneer Communications of America, "you have to lay down a big hunk of data because of the overhead associated with each session." File update capability for CD-R awaits completion, and then widespread acceptance, of the Frankfurt committee's ECMA (European Computer Manufacturers' Association) 168 specification.

Where CD-R is not expected to hurt WORM is in the specialized market for high-capacity storage. The only WORM drives Sony now sells are the 12-inch variety, which offer capacities of 6.5 GB and are often packaged in huge jukeboxes. "CD-R doesn't affect the regular WORM market for us," says Alan Sund, Sony's marketing manager for CD-ROM drives. "It's a totally different product and market, a whole different range of capacity."

Andy Reinhardt is BYTE's West Coast bureau chief. You can reach him on BIX as "areinhardt."

send a tape to your local CD-ROM copy shop and have it make a CD for you. Walnut Creek CD-ROM (Walnut Creek, CA), for example, accepts 8-mm and QIC (quarter-inch cartridge) tapes and charges $195 for overnight conversion to CD-ROM.

Client-Server CD-ROM

The push for a generic client-server model appropriate for CD-ROM has two motivations. The most critical need is to slow the proliferation of user interfaces that comes with a growing number of titles. My local college library has four CD-ROM stations, each with a different title. Because four different vendors produce those titles, there are four different user interfaces to master.

SFQL (Structured Full-Text Query Language), CD-RDx (CD-ROM Read-Only Data Exchange), and DXS (Data Exchange Standard) are among the proposed standards that promise just such consolidation. The viewing application will play the role of client, issuing requests to a data source that acts like a server. The benefit to users will be enormous. Unfortunately, only a few CD-ROM tool vendors have yet embraced any of the proposals now on the table. Many more, including Dataware and SilverPlatter, use a client-server model internally and are waiting for a clear winner to emerge.

A second reason for the client-server model is the need for effective remote access to CD-ROM stations. A file-based CD-ROM application usable on a 10-Mbps LAN grinds to a halt when you connect to those files at 2400 bps. A server-based CD-ROM, on the other hand, could communicate effectively with a remote client even over a slow link. I could dial into the CD-ROMs as I dial into my library's Ultrix-based on-line catalog.

None of these tantalizing future prospects should obscure the central message: Today's CD-ROM, warts and all, is often the medium of choice not only for commercial publishers but also for many forms of corporate communication. Thanks to CD-R, that choice just got a whole lot easier. The history of personal computing has shown over and over that when a powerful technology appears on the desktop, users seize it and proceed to change the world. Here we go again. ■

Editor's note: *BYTE news editors Patrick Waurzyniak and Ed Perratore, West Coast bureau chief Andy Reinhardt, senior news editors Gene Smarte and Tom Halfhill, and executive editor Rich Malloy also contributed to this article.*

Jon Udell is a BYTE senior technical editor at large. You can contact him on BIX as "judell" or on the Internet at judell@bytepb.byte.com.

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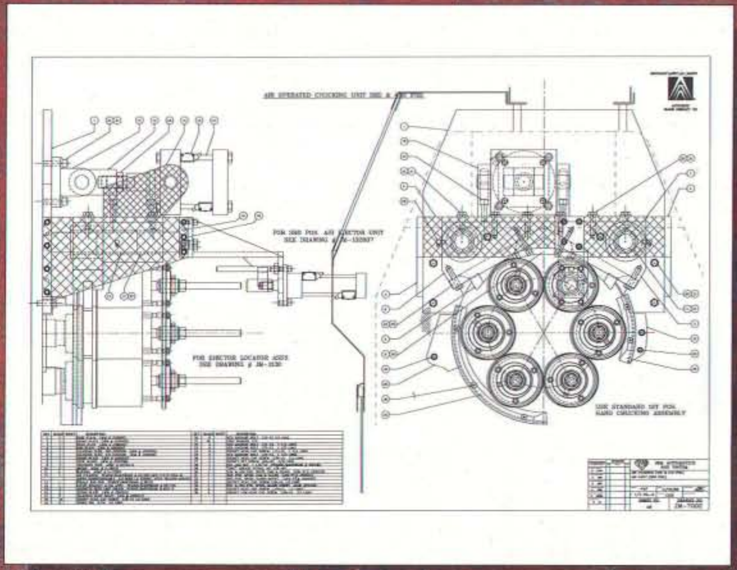
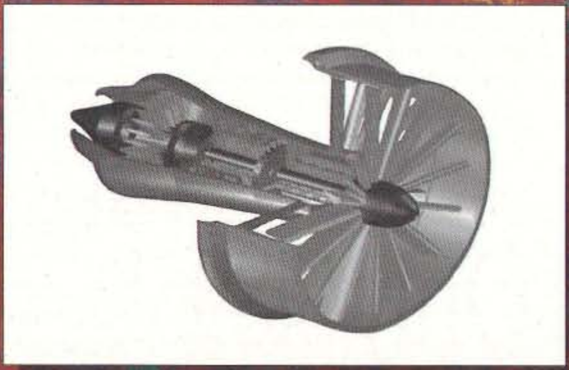


B-size (11" x 17")



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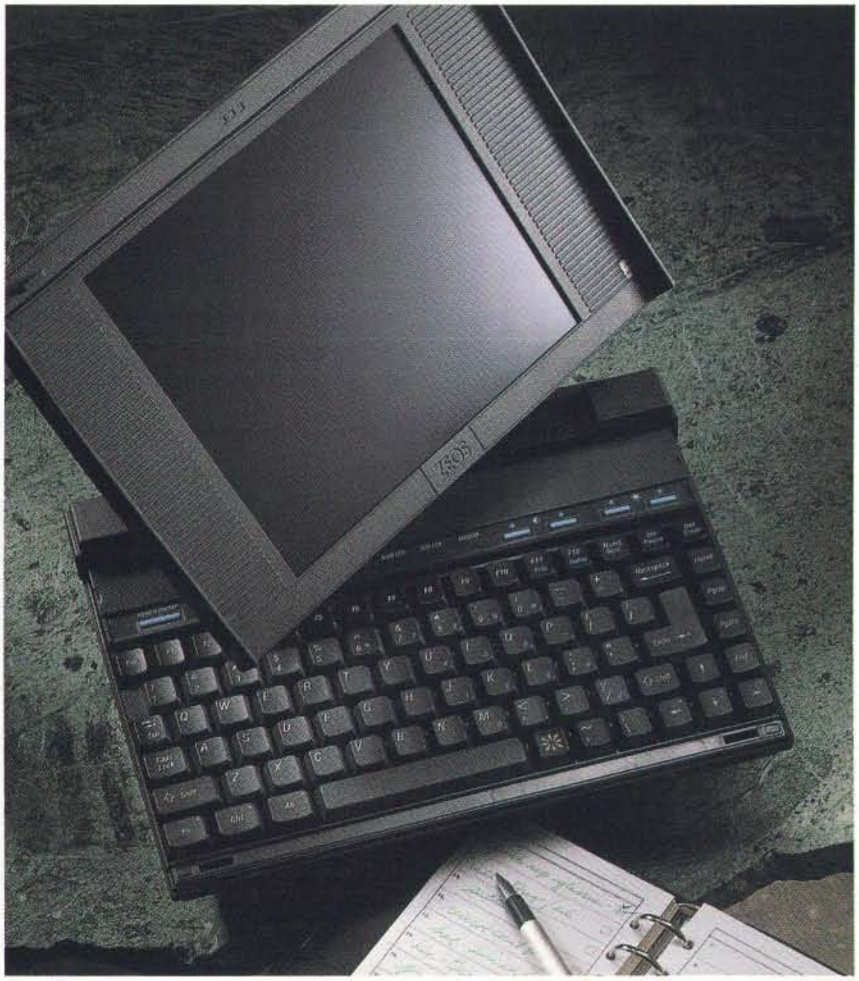

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Is ITV Here to Stay?

ITV brings new information services into your home, but first it must survive

CARY LU

Interactive TV (ITV) bridges the gulf between your computer and your TV. You can exchange information with a control center through a small computer (known in the trade as a black box) attached to your TV. The control center's computer reacts to your input by changing the image on your TV screen.

You can interact with various services. For example, you could compete against TV game show contestants, request further information about an advertised product, tap into a pay-per-use database of up-to-the-minute financial information, or buy a new computer from a mail-order outlet. ITV systems can give you cost-effective, on-demand news, weather, and financial data (see the screen on page 140).

But ITV's detractors question whether it holds any significance for computer users. Many note that ITV's debut comes on the heels of a long list of failed products in related genres. "We are very interested in being the conduit for whatever services the market will pay for," observes Mike Schwartz, vice president for communications at CableLabs, the cable TV industry's R&D arm, "but a lot of our companies were hurt by the earlier versions of two-way television; people didn't buy them."

ITV's proponents argue that the potential ITV market is far larger than that for similar services delivered to a computer by on-line systems. They are convinced that people don't want to learn how to use a computer, preferring instead the familiarity of a TV. "It's easier for people to relate to their TV than to relate to a computer," asserts Paul Sturiale of TV Answer, a start-up ITV company in Reston, Virginia.

To reinforce their product as a TV add-on, several ITV companies downplay any similarities between their black box and a computer. "Our marketing [department] will never say that it is a computer," says Laurence Kirsch, TV Answer's director of user-interface design. "The computer in your office you have to use. A TV product you want to use," he adds.

Sending Signals

The first major hurdle ITV system operators must overcome is how to get a signal from their control center to you. Three major distribution methods are available: radio or TV broadcast, cable TV, and modem (see the figure on page 142).

Operators can broadcast their signal at a variety of places in the spectrum: on a subcarrier of an FM radio station, in the black bar between TV frames (known as the vertical-blanking interval, or VBI), or on a specially assigned frequency. The FCC has already allocated the 218- to 219-MHz bandwidth to

ILLUSTRATION: MICHAEL DAVID BROWN © 1993

ITV, to be split between two services (with 0.5 MHz each) in every city.

FM radio broadcast and VBI techniques generally are limited to 9600 bps for all activities. Because several activities occur simultaneously, the bandwidth is low, and for short bursts, a single activity can take over the entire bandwidth.

Information transmitted via radio and VBI is limited to text, graphics primitives, and information for positioning an object on-screen. With graphics primitives, the outbound ITV signal instructs the black box to place a circle of any size, position, and color on-screen. The black box takes care of the details necessary for generating each pixel of the circle.

None of the broadcast systems can supply photographic images. Graphics and color are limited to simple objects. This restriction means that if you are shopping for a computer, you cannot browse through pictures of computers.

Most ITV broadcast systems can be distributed through cable TV links. Some ITV operators place the outbound signal in the 4-MHz gap between TV channels 4 and 5. Others dedicate one or two video channels to sending data. An ITV system with its own video channel on a cable system can send photographic images, provided that the black box has sufficient memory to store an image. Full-motion video is technically possible but not practical on a dedicated channel, since everyone using the ITV service would have to watch the same image.

Older cable systems are limited to 36 or fewer channels, so, typically, they can't devote free channels to ITV. However, new developments may change all that. For example, many cable companies are replacing older cable with wider-bandwidth coaxial cable that can support about 150 channels. Some companies plan to install fiber-optic cables, which can support hundreds of channels. Still others expect to transmit premium programming using a digital-compression scheme that will support eight or 10 separate full-motion images in the 6-MHz bandwidth now monopolized by a single analog TV channel. However, the initial cost of the decompression hardware—expected to be in the hundreds of dollars—may restrict its use to premium services.

ITV Pros

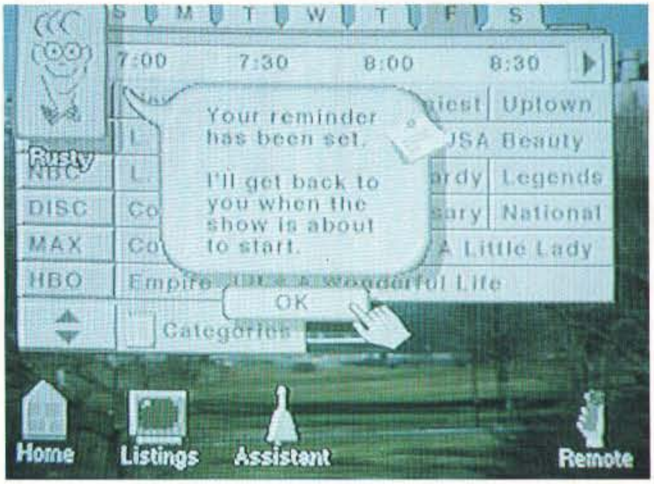
- familiar TV access
- low-cost news and product information
- interaction with favorite TV broadcasts

ITV Cons

- child of failed industries
- speed hampered by present technologies
- limited third-party development options

Assuming there will be extra channels, how will that capacity be used? Not necessarily for ITV, according to cable companies. The most common answer is that extra channels will support multiple feeds of blockbuster movies. A movie will be fed to multiple channels, with staggered starting times. You could choose a convenient starting time, take an intermission, and resume viewing on a later feed.

For interactive full-motion video, the basic architecture of cable TV has to change. Simply adding fiber-optic cables won't be enough; the signal-distribution system has to switch separate video feeds for each interactive customer. Today, most cable systems feed the same signal to each subscriber. Even fiber-optic cables may not have sufficient bandwidth to support thousands of customers pursuing different activities; therefore, at least part of the cable bandwidth needs to be wired in a style like that of the telephone system, with a separate feed to and from each house.


Your reminder has been set.

I'll get back to you when the show is about to start.

Using a hand-held controller, you enter instructions into the black box, which exchanges information with the ITV central control computer. Here, the black box has been programmed to signal the start of a TV show. (Photo courtesy of TV Answer)

Telephone-based ITV can take the form of a traditional modem link. Present modem protocols limit speeds to 19.2 Kbps. On a standard twisted pair of copper wires, telephone companies already offer 56-Kbps digital telephone links or a 64- to 128-Kbps ISDN link, but few sites are set up for such services today. The V.Fast protocol standard, which should be nearing completion by the time you read this, will improve on current modem protocol speeds, but it will not achieve ISDN data transfer rates.

The maximum carrying capacity of twisted-pair cables is much higher, so data rates of more than a megabit per second or a single full-motion-video channel are possible. A video dial tone would let you send instructions as to what you want to see. The images would appear in full motion on your TV screen. When and if fiber-optic cables reach you—either from a cable company or from your local telephone company—multichannel, interactive video will become practical from the technical point of view.

However, fiber-optic cables won't be in place for years because of the high cost and the delays inherent in obtaining approval from public utility commissions. "I would say that it will take five years or so before we start seeing wide-scale deployment of fiber-optic cabling," says Patty Anderson, McGraw-Hill/Datapro's assistant editor/analyst for Voice Networking Systems in Delran, New Jersey. "It'll be another five or six years after that before we'll see a majority of homes and offices wired for fiber optics," Anderson adds.

Sending Your Signals Back

You send your return signal to the ITV control center by modem or low-power transmitter. Your return signal contains minimal data, usually less than 10 bytes for coding your response and another 10 bytes for an identification code. A handheld controller serves as your interface with the black box.

Modem links are easy to establish, since every customer has a telephone line. You can have problems, however, if another family member is using the telephone. Low-power transmitters avoid this problem. ITV operators using the 218- to 219-MHz bandwith expect to set up multiple transmitter/receiver sites in the manner of cellular telephone systems. Thus, the transmitter inside the black box

Representative ITV Services

Not all the following companies fit the definition of an ITV service precisely, but they are representative of the services available today or planned for the near future.

- **XPress Information Services** (Denver, CO) has been in operation since 1985 and has 25,000 subscribers. Its outbound signal is 9600 bps, distributed on an FM radio subcarrier, normally through cable TV systems. Its black box converts the XPress feed into a serial-port stream that's fed into your computer. Software on your computer monitors and picks out items of interest to you. XPress is not interactive; there is no return channel.
- **Videoway**, operated by Le Groupe Videotron (Montreal, Quebec, Canada) since 1990, claims 180,000 customers in Canada and 37,000 more in the U.K. It is based on teletext technology, with no interactivity. Besides text, Videoway can distribute personal computer software (currently all games) through a serial port. To overcome the black box's storage limitations, Videoway sends its data-stream and software inventory over and over again. All computer software offerings are repeated every 15 seconds. Popular text pages repeat more frequently. Because such repetitive transmission requires high bandwidth, Videoway assigns two cable TV channels to support a 4-MBps data transfer rate.

  Le Groupe Videotron is planning to introduce a modem return channel that will add interactivity. The company is also planning a new remote control with a miniature keyboard to support short E-mail messages.
- **Interactive Network** (Mountain View, CA) is a start-up operation based in Sacramento and northern California. It produces its own programming, including games and activities that are tied in to TV programming. TV tie-ins are undertaken without the support of the TV program producers.

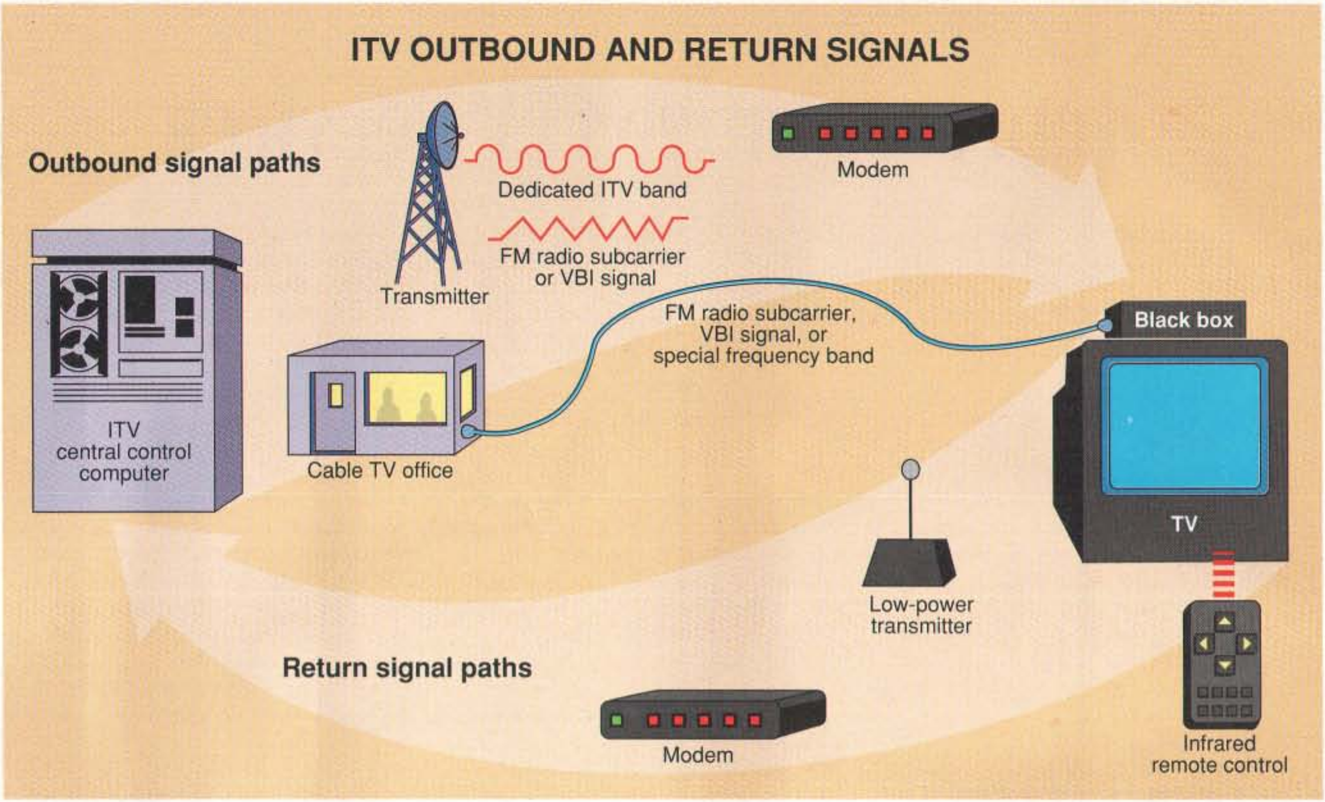
  Interactive Network's outbound signal is broadcast on an FM radio subcarrier at 9600 bps. The return path is sent through a 1200-bps modem. Interactive Network also plans to use the 218- to 219-MHz ITV frequency bandwidth.

  Unlike with other ITV systems, the Interactive Network display does not appear on your TV screen. Instead, its hand-held control unit has a built-in 8-row by 40-column LCD (240 by 64 pixels). In addition, the control unit contains a miniature keyboard (see the photo).
- **TV Answer** (Reston, VA) successfully petitioned the FCC to assign the 218- to 219-MHz bandwidth to ITV services. A license assignment is under way in major cities, and TV Answer plans to begin operations this summer.

  TV Answer's outbound signal (about 12 Kbps) will be broadcast in a manner resembling that of a cellular telephone. A series of cell sites will broadcast throughout a city, and each cell site will serve up to 64,000 customers. If the number of customers increases, more cells can be set up. The return path will be in the same frequency bandwidth, running at 5000 bps.

  TV Answer will be pure interactive; information will be sent only in response to a request. Hewlett-Packard will be the exclusive maker of the 8088-based black box, which will have a serial port and an optional infrared interface that will exchange information with an HP 95LX palmtop computer, small printers, and other accessories.
- **Television Computer** (Pittsburgh, PA) is the brainchild of a number of Carnegie Mellon University researchers. Still in its planning phase, Television Computer will distribute a 5-MBps signal through cable TV. Mostly, the service would be one-way, with a modem return channel. The concept is to make its service open for anyone to supply information and develop applications that monitor the data stream, extracting information when appropriate. Plans call for the black box to be fairly powerful, with several megabytes of RAM and a multitasking operating system.
- **The Tandy VIS** system from Tandy (Fort Worth, TX) is a CD-ROM player for your TV, using a modified version of Microsoft Windows. As such, the Tandy VIS is not interactive in the style of other systems described here, but it contains internal expansion slots that will support interactive operation in the future. Its main competitors, the Philips CD-I and the Commodore CDTV/Amiga systems, do not have a path to such interactivity in their current forms.

Unlike with other ITV services, Interactive Network's display appears on the hand-held control unit and not on your TV. The unit has an 8-row by 40-column LCD and a miniature keyboard. (Photo courtesy of Interactive Network)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Black box
ITV central control computer
Cable TV office
TV
Low-power transmitter
Return signal paths
Modem
Infrared remote control

The ITV central control computer transmits signals by FM radio subcarrier or TV broadcast, cable TV, or modem. Your return signals are transmitted via a modem or a low-power transmitter. A black box attached to your TV decodes and encodes signals, and you can program it to scan and store specific information and broadcasts via a hand-held controller.

would need only a few watts of power.

With either method, it takes 5 to 10 seconds to establish a connection and get a screen response. Often, the software inside your black box can supply the necessary interaction, speeding its response time.

In principle, two-way cable systems can support higher-bandwidth return channels and faster response times. But two-way cable is used mainly to support relatively simple features, such as pay-per-view. As with a radio return path, a cable return path eliminates any problems that you might have with someone else using your telephone line.

Information Publishing and Fees

All ITV systems have a gateway at the control center that formats information for distribution. The system operator acts as publisher and decides what information is sent to you. The information can be sent to all customers, to some customers, or just to you.

An ITV operator transmitting at 9600 bps sends out some 90 MB of data each day. This is equivalent to 90 big city newspapers arriving on your doorstep. You can program your black box to continually scan this data and pick out only what interests you. Some ITV systems let you program your black box to switch on your VCR and record this specialized data.

Pure interactive systems only send information on demand. If you do not request information or an interactive feature, nothing is sent, aside from occasional software updates for the black box or program guides.

Other systems mix interactivity with data broadcasting. In this scheme, when the bandwidth isn't needed for interactive information, the system transmits an endless stream of data, such as a delayed stock market ticker, news wires, text from magazines, and so on.

Having both pure interactive systems and broadcast models leads to two different ways to charge for services. Pure interactive systems keep track of every request you make and then charge for each transaction. You, an information provider, or an advertiser might pay that fee, and there may not be a subscription fee. Broadcast ITV systems generally have subscription fees, typically ranging from $15 to $20 per month. A broadcast system can also charge for interactive activity. Almost all systems levy a service fee when you purchase something, and interactive games may have special fees tacked on to the regular charges. For example, Interactive Network (Mountain View, CA) charges $15 per month for basic services and $20 per month for special activities. Besides transaction or subscription fees, most operators charge $200 to $700 for the black box.

Services Are Familiar

Today's ITV operators offer services such as news, weather forecasts, and community BBSes, all of which are familiar to users of services like BIX and Prodigy. Electronic messaging and banking are possible, but at present they are a low priority for most ITV operators.

Many ITV operators offer locally originated and distributed information as well as a nationwide signal. For example, an office-supply shop may want to sell only in its delivery area. Such localized content is possible if the system knows the location of each customer. All systems can localize to some extent, and some can position users down to a city block.

Most ITV systems are not open to customer-supplied

The death of DOS

Has been greatly exaggerated

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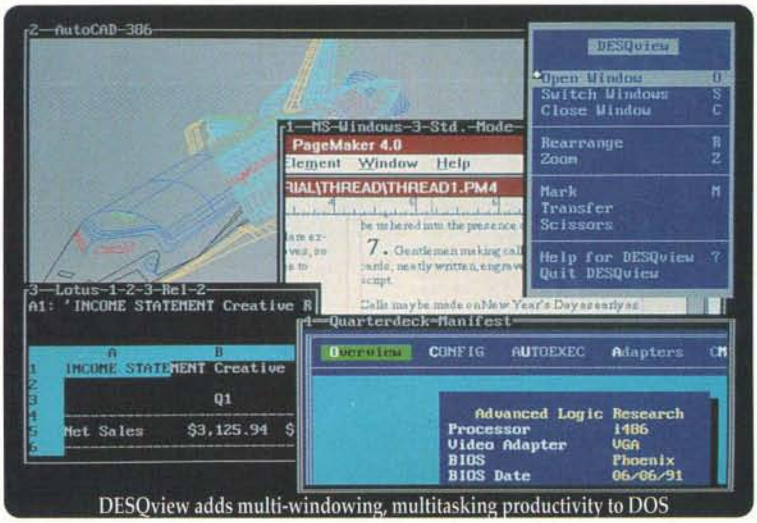

DESQview adds multi-windowing, multitasking productivity to DOS

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messages for either computer conferencing or E-mail. One reason for this is that your hand-held controller generally lacks a keyboard, so you have to "type" by selecting letters on your screen with a joystick or arrow keys. Also, such relatively complex actions clash with the philosophy underlying ITV: The main services should be easy and entertaining, just like TV.

Black-Box Programming

Can independent software developers write programs for the black box? It's too soon to tell. Today's ITV systems are closed; the system operator controls the software. Every operator encrypts signals and uses passwords. While some ITV operators have indicated that they may distribute independently developed software, how this would be arranged isn't clear yet.

Also, most black boxes accept only software that the ITV operator distributes. They lack disk drives, cartridge slots, or other access to the processor. Consequently, independents cannot make their own black box without approval from an ITV operator. Some of the approved black-box manufacturers include heavyweights such as HP and Zenith Electronics.

Will ITV Survive?

The history of interactive services is marked by failure. In the 1970s, Warner-Amex Cable's Qube interactive cable service flopped. In the 1980s, teletext and videotext services were introduced. Teletext offered news and other information through a VBI signal on broadcast TV. Videotext offered interactive data through a telephone line, complete with graphics and color. Several multimillion-dollar efforts failed (e.g., Knight-Ridder's Viewtron videotext experiment in Florida). A handful of teletext-style services are still available on some cable systems, and the Canadian Videoway service is modeled after teletext technology (see the text box "Representative ITV Services" on page 141). Prodigy keeps the videotext concept alive.

In spite of this checkered past, ITV proponents insist that their time has come. Things are different today, says Richard Cassam, head of new market development for Tandem Computers (Cupertino, CA), a member of the First Cities, which is a 13-company project aimed at eliminating the technical barriers to the delivery of interactive multimedia products. Cassam cites a shift in technology and market acceptance. "More and more things in your daily life mix media," he says. Cassam gives as examples Apple's QuickTime movie standard, picture-in-picture TVs, videophones, and smartphones.

Yet when you consider the history of related services and the technical developments required to bring ITV into the mass market, it's easy to predict that ITV will go bust. "At the very best, there will be a two- or three-year shake-out, lasting through 1996," says Gary Arlen, president of Arlen Communications (Bethesda, MD), a research company specializing in interactive media.

Arlen predicts that major entertainment and information providers, such as computer game companies (e.g., Sierra Online) and publishers (e.g., McGraw-Hill), will stay on the sidelines until after the shake-out. "Then you get into a period of serious competitive marketing," Arlen says.

Others just don't know. "It's either going to be boom or bust," says Laurie Frick, HP's product manager for TV Answer's hardware. "In five years, we will be in way over 5 million households—or way under." ■

Cary Lu has worked for Children's Television Workshop and the Nova *series of science documentaries and as an animation producer. He is author of* The Apple Macintosh Book *(Microsoft Press, 1992). You can reach him on BIX c/o "editors."*

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STATE OF THE ART

WIRELESS MOBILE COMMUNICATIONS

The infrastructure for ubiquitous wireless data communications is rapidly expanding

JOHN P. MELLO JR. AND PETER WAYNER

In the early days of personal computing, data communications via modems was a black art that was best left to experts. But as the demand for services such as E-mail, file transfer, database access, and remote log-in grew, so did the size, number, and types of data communications services. Accessing them became easier, too. Not surprisingly, the same proliferation of services is taking place in the world of wireless data communications.

Wireless data communications is still principally the domain of large companies with specialized needs, such as a delivery service that must keep track of trucks and packages or a large sales organization that needs to stay in touch with a mobile sales force. This situation is about to change: Within three years, wireless data communications will be as commonplace as wired data communications is today.

Why Wireless?

Two forces are at work to make wireless data communications one of the most important technologies of the next decade. The first is the trend to untether computers from the desktop. With every improvement in integration, miniaturization, and battery technology, the difference between the performance of desktop computers and portables shrinks, as does the premium you pay for portability.

The second force driving wireless data communications is the desire for universal connectivity. Computers and their users are more productive when they have access to external data. The explosive growth in LAN installations over the past five years is ample evidence of the importance placed on connectivity by the business world. Normally, the forces of portability and connectivity are at odds, but wireless data communications lets you have the best of both worlds—freedom from the desktop *and* connectivity.

Wireless Highways

Despite the narrow focus of current wireless applications, a wide range of wireless transmission media are available. With wireless networks expanding to target general computer users with services such as E-mail, access to standard information services, and support for remote sessions on host computers, you can expect the range of options to grow even more.

The market is made up primarily of RF packet-switched services and cellular phone companies, but this will change as the FCC recognizes the needs of mobile computer users and allocates larger sections of the radio spectrum to what it calls PCSes, or personal communication services (see the text box "PCS and You" on page 148).

Although wireless data communications offers the advantage of not being wirebound, it has its disadvantages as well. First, the radio spectrum is often noisy and prone to losing bits. Losing a few bits for each hundred or thousand that are transferred is not noticeable during a telephone conversation or while listening to a radio program, but it's disastrous during data transfers. Second, the cost of wireless data communications is higher than that of wired communications in the initial outlay for equipment and in the cost of using the services. For example, with a cellular modem, you have to pay for the cellular service that connects you to the phone system and reckon with the standard telecommunications charges from, say, BT Tymnet or MCI Mail (see figure 1).

Advanced digital technology, error-correcting codes, and compression algorithms are beginning to provide robust

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PCS and You

Although the cellular communications' infrastructure offers advantages, new wireless communications companies and services are springing up. Recently, the FCC proposed allocating three new 30-MHz blocks of the radio spectrum for organizations developing PCSes (personal communication services) that can include both data and voice transmissions. The FCC has placed no restrictions on the use of this part of the spectrum, and it's actively encouraging companies to come up with new and better services.

American Personal Communications (Washington, DC), Cox Enterprises (Atlanta, GA), and Omnipoint Communications (Colorado Springs, CO) have been tentatively granted pioneer status for their work in PCSes, which could eventually help them get a license for part of the spectrum. APC intends to offer digital voice and digital data transmissions over this part of the spectrum. And Cox has plans to provide links with cable TV so that people can offer feedback on TV programs.

The PCS area of the spectrum is undeveloped, and it will be some time before companies begin to market services that use these bands. This area, however, offers the greatest hope for innovative, interactive networks. Only time will tell whether those in the industry have the imagination and the capital to find markets for their PCSes.

solutions to many of the noise problems, and competition and the economies of scale should help bring down costs. For the foreseeable future, however, you should expect to pay a premuim for wireless connectivity.

The wireless data communications infrastructure consists of many technologies. Most require that you subscribe to a service offered by a centralized provider. But the FCC is investigating plans to reserve more of the broadcast spectrum for unlicensed data transmission (see the text box "Broadcasting Without a License" on page 150).

You can categorize centralized systems as either one-way or two-way. One-way systems (e.g., pagers) broadcast data to a mobile platform and are ideal for many vertical applications (see the text box "One-Way Transmissions" on page 152). Most general computer users, however, need the type of two-way connectivity provided by wired connections.

Today, such users have several alternatives. They can connect a cellular modem to the existing AMPS (Advanced Mobile Phone System) infrastructure—commonly called cellular—which operates in the 825- to 890-MHz bandwidth, or subscribe to one of two RF systems, which operate in the 900-MHz range.

On the Radio

RF systems send data in packets that range in size from 240 to 500 bytes, which is a method that is less susceptible to adverse conditions than continuous cellular transmission. One of the first packet-switched two-way products available to the general public was the Mobidem modem, made by Ericsson GE Mobile Communications (Paramus, NJ). The company now sells the modem bundled with an HP 95LX computer and a subscription to RadioMail's gateway to the Internet. The modem measures 8 by 3 by 1.3 inches and weighs about a pound (see the photo). It's heavier than one-way receivers, which weigh 2 or 3 ounces, because the circuitry must supply, the power to send a signal back to the base station. The Mobidem/HP 95LX/RadioMail bundle costs $1995.

In addition to the Internet gateway, RadioMail (formerly Anterior Technology, Menlo Park, CA) provides a number of gateways between the wireless and the wired worlds. It provides the "glue," for example, that makes it possible for you to send a message to an MCI Mail or GEnie subscriber from a Mobidem-equipped machine.

The Mobidem communicates over the RAM Mobile Data wireless network (RAM Mobile Data, Woodbridge, NJ). RAM Mobile Data has put up antennas in many East Coast cities and has plans to cover the 100 largest metropolitan areas in the U.S. This year, the company expects to cover about 90 percent of the U.S. industrial population in its service area. The company also plans to saturate the transportation corridors between Boston and Washington, D.C., and between San Francisco and San Diego so that customers driving along the rural stretches of I-95 or I-5 will be able to get their E-mail.

The RAM Mobile Data network uses the Mobitex packet-switching technology, which like cellular technology can hand off communications to other transmitters. Mobitex networks operate in the U.S., Canada, the U.K., Sweden, Norway, and Finland, with others to follow in other European countries and Australia. The RAM mobile Data network can accommodate 16 million unique addressees, with 3 million of these allocated to Canada's Cantel network to permit cross-border communications.

A similar system of city-based radio towers is operated by Ardis (Lincolnshire, IL), a partnership between IBM and Motorola. Originally set up as a network for IBM service technicians, the Ardis wireless network reaches over 8000 cities and towns throughout the country. The company sells its services only to large OEMs and corporate information services. For example, Otis Elevator funnels its service calls to its headquarters in Hartford, Connecticut. The calls are then forwarded to the Ardis network and broadcast to service

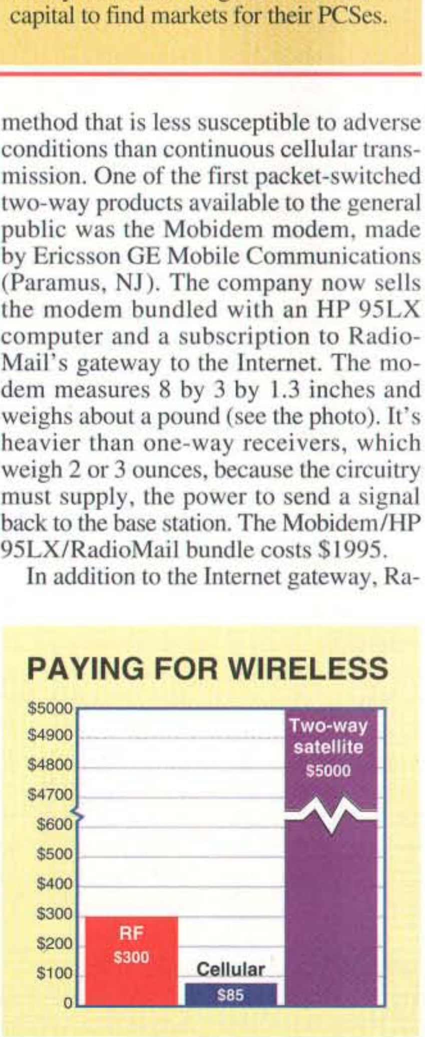


Figure 1: *The premium you pay to transmit 500 KB of data using wireless communications differs depending on the medium you use. The packet-switched radio data is for the RAM Mobile Data network, and the satellite data is for Inmarsat. The cellular data assumes 2400-bps throughput and a $50-per-month access fee. Capital costs, which are not included in the figure, run about $1500 for packet-switched radio communications, $1000 for cellular communications, and $10,000 for satellite service.*

technicians in the field.

The Ardis network also enables Avis to process a customer's car request in the time it takes the customer to take the Avis bus from the airport to the company's car lot. According to Robert B. Euler, vice president of marketing for Ardis, a unique feature of the network is its reliable in-building communications capability, which is important in metropolitan areas.

Packet-switched radio communications are expensive. For instance, a basic subscription to the RAM Mobile Data network costs $89 per month, which includes 100 50-word units. Additional 50-word units cost 29 cents each. This is on top of any fees charged by E-mail or gateway providers, such as AT&T Mail, which will provide a connection to the RAM Mobile Data network this year.

Another drawback to packet-switched radio communications is the incompatibility of modems used by the different services: The Ericsson GE Mobidem works only with the RAM Mobile Data network, and the Motorola RPM 840 is compatible only with the Ardis network. However, the Motorola Infotac modem, which works with off-the-shelf software, will be compatible with both systems.

In the Wings

Last summer, the FCC gave the nod to Mobile Telecommunication Technologies (Jackson, MS) to build the third nationwide wireless data network. The proposed network would run in a 50-kHz block of the 931-MHz band and simulcast data at 24,000 bps (Ardis is just now implementing speeds of 19,700 bps on its system).

According to Mtel, its network will achieve the high data transfer rates by enhancing a technology called MCM (multicarrier modulation). In conventional paging, a baud is equal to a bit, but with MCM, a baud is 8 bits. Thus, Mtel can get higher data throughput for a given data transfer rate.

That's important because of the trade-off between simulcast's superior area coverage and its slow data transfer rates. MCM provides for high-speed simulcasting. Donald Warfield, vice president for strategic marketing for SkyTel, which is also owned by Mtel, says that simulcast is more reliable for building penetration and provides seamless coverage throughout an area.

Mtel's plans for its nationwide wireless network are ambitious. Among the services it expects to provide are acknowledgment paging with prestored messages using conventional pagers, two-way data messaging with palm-size computers or PCMCIA cards, fixed-location data distribution (e.g., point-of-sale terminals), remote data collection, information services, E-mail services, industrial remote control (e.g., monitoring alarms and reporting stolen vehicles), and integration with mobile satellite services to provide seamless network coverage. Mtel expects the network to be operational 12 to 18 months from the time the company receives approval from the FCC, which could come this year.

The 1-pound Mobidem provides connectivity within the service area of the RAM Mobile Data network.

Cellular Connections

Although they rely on a less-robust analog technology, the cellular phone companies have a number of structural advantages over the data-only networks (e.g., RAM Mobile Data and Ardis)—the most important being the installed base of cellular transmitters. Nearly all U.S. cities have two or more competing cellular phone systems. And most important, cellular phone hardware is relatively inexpensive: about $100 per phone in wholesale amounts. These phones need just a modem and an adapter to start transmitting data. You can buy a mobile phone/modem combination for the average laptop for less than you would pay for a Mobidem.

Many companies produce cellular modems and adapters that can be plugged into cellular phones. For example, Microcom (Norwood, MA) recently began shipping the MicroPorte 4232bis with fax modem. This portable modem comes with MNP 10, a protocol designed to work in the sketchy world of cellular communications. Zyxel USA (Anaheim, CA) is another company that is making a push in the cellular modem market. Like Microcom, it has included a number of features with its modems to improve the reliability of cellular data transmission.

The MicroPorte and other cellular modems don't require special equipment from the cellular communications provider, although the MicroPorte must be connected to another MNP 10–capable modem to use MNP 10. In addition, regular modems require an adapter to simulate central-switching functions that a modem expects (e.g., a dial tone).

Special protocols like MNP 10 are needed because, unlike their wirebound kin, cellular modems must deal with an adverse environment. For instance, when you place a cellular call, a signal is sent to a transmission tower. Each tower covers a cell about 8 miles in diameter. When you travel from one cell to another, your signal must be handed off to the next cell. When this happens, there's a break in the signal, lasting from a few hundred milliseconds to over a second. It's enough to give conventional modems fits, because they depend on continuous signals. Cellular modems, on the other hand, are designed to operate in this flaky environment. They perform error correction and data compression, increase or decrease transmission speed, change packet sizes, and counteract fluctuating signals.

Cellular modems are also expensive, due primarily to the robust error checking they require and the fact that the market for them is smaller than the market for conventional modems. Cellular modems can cost as much as $1500, and then there's the cost of the phone calls. With a subscription to a cellular carrier costing $40 a month and calls costing 60 cents a minute during prime time, you can run up a hefty phone bill in no time.

Packet-Switched Cellular

Because data transmission over cellular voice lines consumes a lot of the voice bandwidth in a cell, cellular companies are constantly investigating other methods of sending digital information over cellular lines. One strategy using analog cellular transmission for data communications is CDPD (cellular digital packet

Wireless Data Communications

- paging and messaging
- E-mail
- file transfer
- anywhere-anytime connectivity

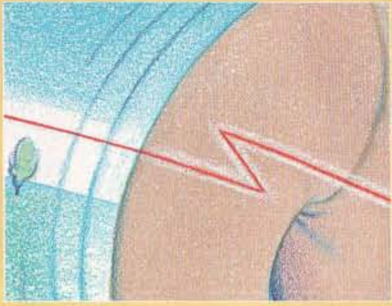
Broadcasting Without a License

Most wireless services require that you subscribe to a central service run by a licensed company. These companies manage their radio spectrum and charge for every byte going through their gateways.

The FCC is marking off a portion of the spectrum for unlicensed, low-power use for mobile computers. These bands will let you set up wireless networks within a building so that laptops and other computers can be moved from desk to conference room and still maintain links with the network.

The FCC proposes to set aside 20 MHz of bandwidth (1 × 10-MHz channel, 4 × 1.25-MHz channels, and 50 × 100-KHz channels) for unlicensed service in response to a request from Apple Computer. The power limitations should prevent a signal from propagating beyond the floor of a standard office building.

Naturally, these systems could lead to chaos if everyone started transmitting in such a narrow part of the spectrum. In fact, carriers like the RAM Mobile Data network and the cellular telephone companies are counting on this chaos to drive customers to their proprietary networks, where they provide management. The unlicensed bands, however, don't need to be Babel-like. It's possible to create standards for these bands that will be strong enough to maintain order within the band.



The WINForum (Wireless Information Networks Forum) is an industry group based in Arlington, Virginia, that designs protocols for unlicensed networks. It's determining what power levels should be used by the devices and how long the devices should be listening for free air time before broadcasting.

The final WINForum model may be similar to the Ethernet standard, which requires each computer to "listen" for a random amount of time before sending a packet. The group was to release a suggested etiquette for using the spectrum by the end of 1992, and devices using this part of the spectrum could arrive by 1994. The FCC must approve the plan before manufacturers can ship these products.

Most manufacturers and the WINForum believe that the 20-MHz block of the spectrum (1910 to 1930 MHz) proposed to be allocated to unlicensed systems is hopelessly inadequate for the demand. They expect such devices to find widespread acceptance. When that happens, they hope the FCC will realize that this technology is the best way to provide short-range wireless service to the country. Benn Kobb, president of the WINForum, says, "The radio spectrum is public property. Citizens, schools, and businesses need to have access to it."

data), a technology for transmitting data over unused cellular channels based on IBM's CellPlan II technology.

CDPD offers high bandwidth (about 19Kbps with compression) and continuous connections to networks like the IBM data network. IBM, for instance, will offer 3270 emulation over the airwaves. And CDPD systems can offer more than the store-and-forward E-mail systems, because the high bandwidth makes it easy to run a remote session from a ski lift or a dive shack.

In conjunction with IBM, nine of the country's 10 largest cellular companies are testing CDPD in the San Francisco Bay area. The availability of CDPD in the future will depend on whether your local cellular telephone company decides to install the necessary hardware. The cost for a mobile phone/modem combination for a laptop will be from $200 to $400, with the cost of monthly service varying from carrier to carrier. Rob Mechaley, vice president of technology for McCaw Cellular (Seattle, WA), says that his company is looking at options that will provide basic CDPD service for $35 to $50 a month.

CDPD uses a full voice channel—all 30 KHz. CDPD hops from channel to channel to avoid interference with voice transmission. Even in heavy traffic, there's excess capacity that can be used for data. For example, a guard-timing interval between voice assignments can last as longas 10 seconds. "You can transmit a tremendous amount of data in 10 seconds," says Joe Grlica, director of business development at Bell Atlantic Mobile Systems (Philadelphia, PA).

According to Brandon Nixon, product-line manager for CDPD at Pacific Communications Sciences (San Diego, CA), a final specification for the technology was expected to be published by the end of 1992, and hardware for it should start appearing by mid-1993. But skeptics say that time frame is too optimistic.

"They've got a lot of work to do," says James Hobbs, vice president of BellSouth Mobile Systems (Atlanta, GA), which has a stake in RAM Mobile Data. "I do not think it will be deployed for another four years." Hobbs believes that CDPD was announced early to preempt the development and implementation of competing technologies.

Living in the Shadows

Cellular Data, Inc., (Palo Alto, CA) offers a system that provides data communications over cellular telephone systems. In the cellular system, voice frequencies are separated by 3-kHz frequencies called *guardbands*, which prevent voice calls from interfering with each other. CDI's system uses the guardbands for data communications.

The company acknowledges that its system will not have the same capacity or bandwidth as the CDPD approach, but because it requires less power, the transceivers can be smaller and have less battery power. CDI hopes to attract customers who need services such as electronic messaging but don't need to run remote sessions with host computers over the air. Because the parts of the radio spectrum

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One-Way Transmissions

The original mobile data communication system was the pager, which lets you receive data transmitted from a central antenna over a wide area. Pager technology has improved dramatically, and the best modern pagers can receive and display a stream of alphanumeric characters.

SkyTel (Washington, DC) is the nation's largest paging and messaging service, with 188,500 subscribers. One advantage SkyTel has over most two-way systems is its range of coverage. Using the Westar IV communications satellite, messages are beamed to hundreds of ground stations simultaneously. "SkyTel blankets North America," a company representative explained, "so I could reach you with your pager or palmtop far more easily than I could track you down with a cellular phone."

SkyTel also has links to the major E-mail systems. When you receive an E-mail message, you receive either an alert or the first 240 characters of the message. You can access the full message from a wired system.

Boynton Beach, Florida–based EMBARC/Motorola's EMBARC (Electronic Mail Broadcast to a Roaming Computer) system is smaller than SkyTel, although it was scheduled to be in 220 cities and reach 90 percent of the U.S. industrial population by the end of 1992 (see figure A). Its messages, however, are bigger (up to 1500 characters) than SkyTel's. In addition, the EMBARC system transmits 8-bit data, so binary files can be moved on the system. SkyTel transmits only 7-bit data.

EMBARC/Motorola implemented a messaging switch based on the X.400 standard, which opens its system to a wide range of E-mail systems. You can tag a message you have received and write a response. The next time you're connected to a modem, select the EMBARC option in your E-mail package, and the EMBARC system automatically logs you onto the switch and sends your response to the sender via the X.400 gateway.

Brad Davis, director of strategic marketing at EMBARC/Motorola, says his company's system offers another advantage. "A broadcast fax has an incremental cost per recipient," he says. "With EMBARC, you can send a message to 1000 people at the same price it costs to send it to just one."

The EMBARC system uses Motorola's NewsStream receivers, which cost $395. Motorola has announced a PCMCIA-2 version of the NewsStream that will have a larger internal memory (128 KB) and fit inside laptops. According to the announcement, this unit should ship in the second quarter of 1993 and sell for under $400.

EMBARC/Motorola charges a subscription fee of $15 a month, which includes an on-line version of *USA Today*. The price of messages is based on their size and the priority assigned to them. To send a 100-character message with overnight priority costs 5 cents; to send a message of the same length with immediate priority costs 50 cents.

Recently, EMBARC/Motorola and Individual (Cambridge, MA) created a service called Heads Up. Subscribers to the service receive abstracts of articles from 96 categories. A subscriber can obtain the full text of an article by dialing an 800 number and identifying the piece with a serial number. The service simply loads the text into the subscriber's electronic mailbox. Heads Up costs $30 a month for four categories and $15 for each additional four categories. Full-text versions of stories cost $5.95 each.

Ex Machina (New York, NY) devotes itself to providing services that enable you to connect your computer to a paging system. The system works with a Motorola pager/receiver that can store up to 2000 alphanumeric characters and forward the data through a serial port. This capability allows you to update laptop computers or personal assistants remotely. For example, a secretary in a main office can cancel or add appointments to a calendar and transmit the changes to a salesperson's portable calendar.

Ex Machina offers developer's kits that enable DOS, Windows, and Mac developers to incorporate wireless data transfer into their applications. The company plans to incorporate other platforms in the future. Ex Machina is also offering software called Notify, which will serve as a gateway between the popular QuickMail program running on the Mac and roaming pagers.

Another company set to offer one-

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used in the CDI approach are different than those used by the CDPD system, some cellular carriers may install both systems and let their customers choose. CDI is currently running a test system in Pueblo, Colorado.

Bell Atlantic expects to start selling the CDI system commercially in the first quarter of the year in 25 to 30 cells in the Baltimore area. Among the applications Bell Atlantic sees for the technology are point-of-sale verification, telemetry, vending-machine management, and alarm systems.

According to Mike Franklin, director of product management for wireless data at Bell Atlantic, the CDI system can make alarm systems more secure, because there are no wires to cut. Alarm services in areas not easily accessible to wired networks (e.g., the monitoring of construction sites) are also ideal for the system. "It's totally portable. It can be here one day and there tomorrow, without having the alarm circuit reinstalled," Franklin says.

Pros and Cons

With billions of dollars at stake, a war of words has broken out between cellular companies and RF service providers. Says Bell Atlantic's Grlica, "We can utilize our infrastructure to keep the cost of our data network much lower than [that of] others who have to build from scratch."

Lee Horsman, marketing manager for CDI, also cites the advantages of the cellular infrastructure, with its technical personnel and 8000 sites. Each site can send packet-switched data cost-effectively anywhere in the world, because they are all connected to the public switch network, he says.

But the breadth of the existing cellular system also has disadvantages, according to Ardis's Euler. If the cellular companies

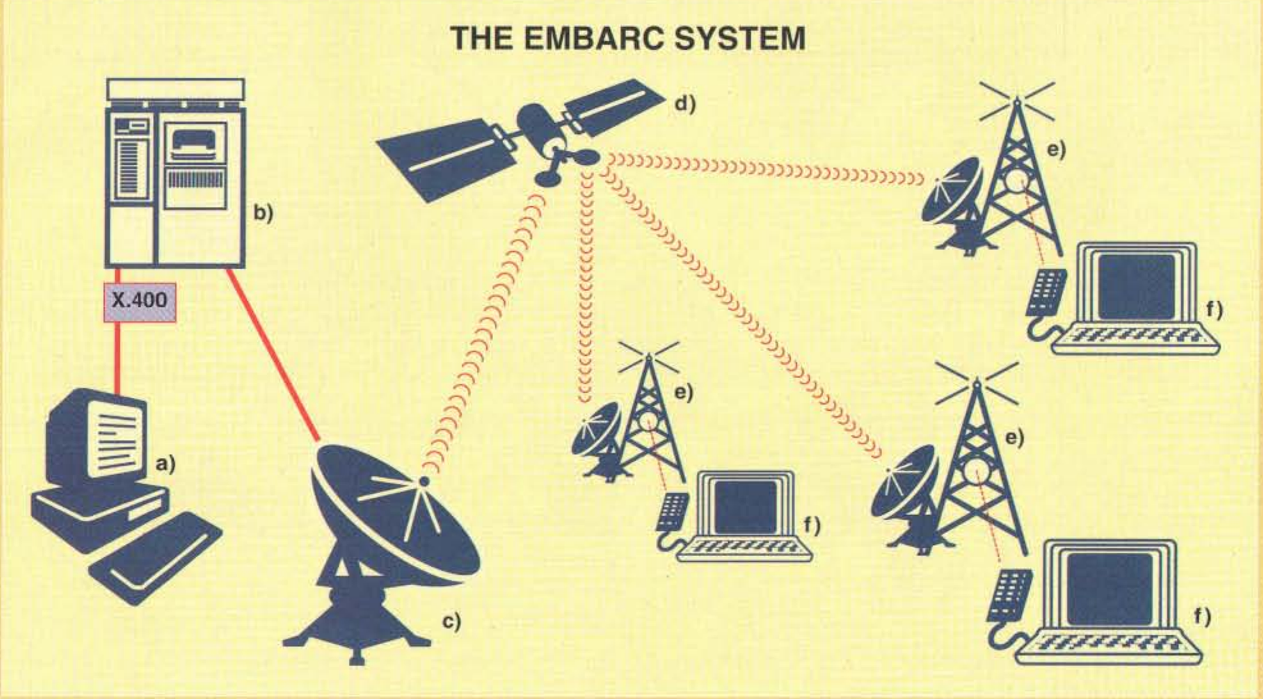


Figure A: *You send an EMBARC message from your computer or workstation* **(a)** *using X.400 to the central EMBARC switch* **(b)***, where a satellite uplink* **(c)** *transmits it to a satellite* **(d)***. The satellite sends the message to downlink stations* **(e)***, which relay them to NewsStream receivers* **(f)***.*

way E-mail is Cue Network (Irvine, CA). Its ComCard will plug into a Sharp Wizard. The network will offer standard pages, fax mail, voice mail, E-mail, or specialized dispatch messages for trucking companies. The network will also broadcast specialized traffic reports through automatic traffic reporting systems run by Caltrans in California and by the Ministry of Transportation in Ontario, which plans to test this system in Toronto soon.

Mainstream Data (Salt Lake City, UT) is offering a continuous data stream through a combination of satellites and FM radio stations. If you live in a major metropolitan area, you can access the data from the air; if you live anywhere else in North America, you need a 30-inch satellite dish to receive the information. Mainstream offers many news options, including UPI, AP, Dow Jones, Reuters, and more offbeat services like the SportsTicker. An FM receiver costs $495; the satellite receiver is priced at $995. The cost of services ranges from $80 to $1000 per month, with the AP wire service fetching the top price.

These systems will likely appeal to companies that need to provide low-cost, limited messaging services in one direction. The systems can use existing paging systems to send large blocks of data, which lowers the cost of the service.

plan to use a packet-switched data architecture, it will require new equipment in each cell site. The capital investment needed to achieve comparable network performance with an existing wireless data network would be substantial.

Aside from the capital costs, industry executives contend there are other reasons why the cellular system is inadequate. SkyTel's Warfield says that the cell configuration of the network means that receivers can communicate with only one transmitter at a time. When people want to transmit data, they have to pull off the road, turn on their cellular phone, move it around until they get a strong signal, and transmit.

Euler says that cellular communications are optimized for mobile users, but for in-building communications, packet-switched radio is more reliable. Ardis has approximately 35 antennas in the Chicago area, with in-building coverage for a 35- by 70-mile region. According to Euler, Ardis would need only from five to eight antennas for vehicular coverage.

"Packet switching is only a way to lower the cost for the cellular companies," Warfield says. "It won't increase reliability. It won't get into buildings any better than it does now."

A Place in Space

The two-way systems described thus far are earthbound: They rely on ground antennas to transmit data to roaming computers. This approach works well in New York City, where the population density can support a large packet-switched data transmission system or cellular infrastructure, but it just will not work in Alaska, where cells can be few and far between. Fortunately, satellites are able to fill in the holes.

The Omnitracs system, which is produced by Qualcomm (San Diego, CA), lets you receive messages anywhere in the U.S.

continued

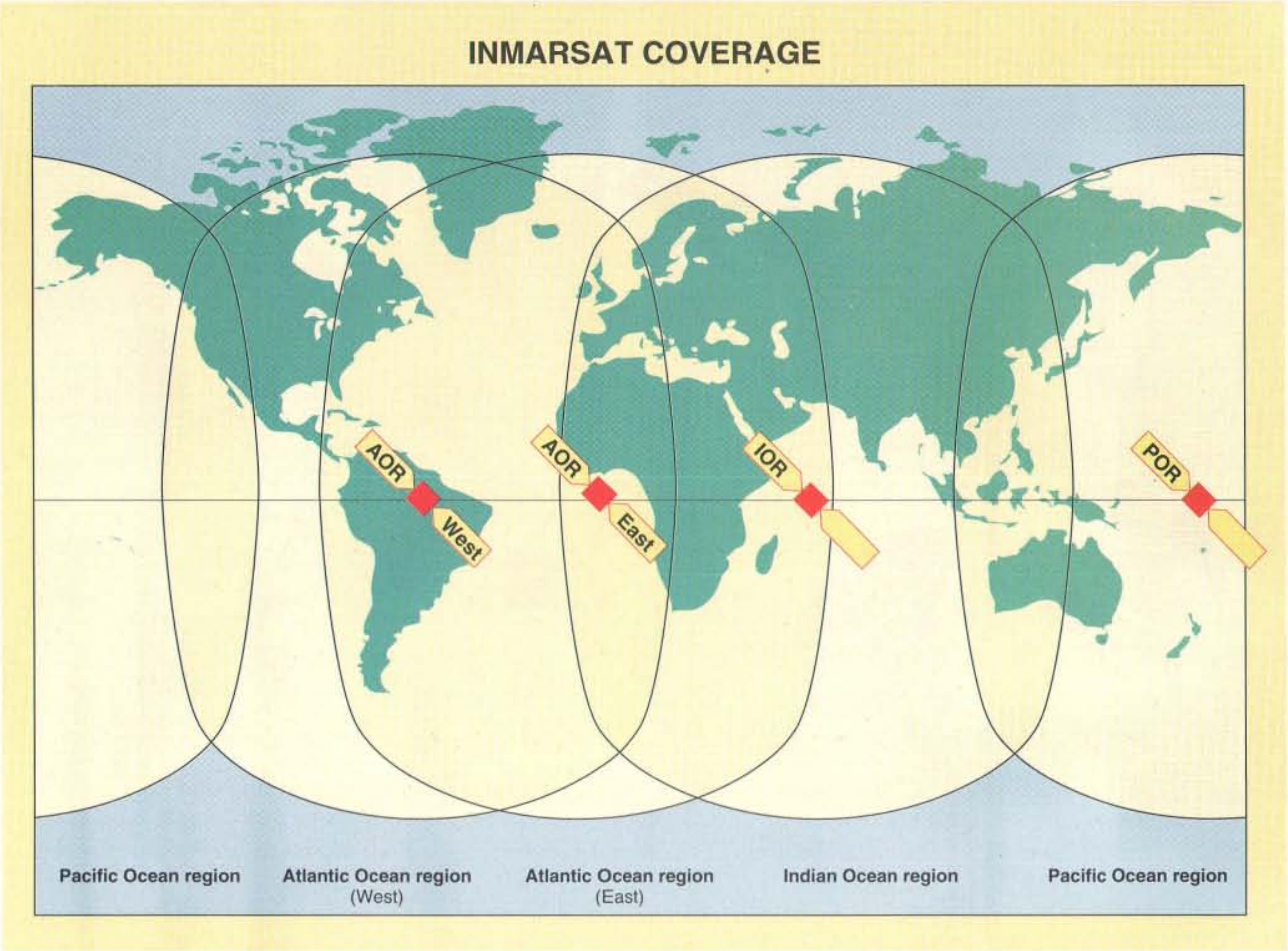


Figure 2: *Using four geosynchronous satellites, Inmarsat provides coverage to most of the earth's surface.*

Omnitracs is marketed to trucking companies, but some individuals use it, too. Steve Roberts, a spokesman for Qualcomm, drives around the country on a pedal-powered bicycle equipped with the system. The flexibility and mobility of the system, however, require large antennas (the antennas are about the size of a basketball, and they come in weatherproof housing for mounting outside of a truck) and power supplies that can't be carried around and run off AA battery power.

Mobile Telesystems (Gaithersburg, MD) offers Inmarsat, a competing system that covers every location on earth except the North and South Poles (see figure 2). During the Gulf War, CNN correspondent Peter Arnett used the Inmarsat system to send his reporting out of Baghdad when the allied air attack began. He scooped the other networks because, unlike the telephone lines that were cut soon after the attack began, the satellite system continued to operate.

The Inmarsat system provides two different levels of service. The first level transmits voice communication for about $7 a minute using a base station that retails for $45,000. The second level provides packet-switched data for about 1 cent a byte. This 13-pound system costs $10,000. The central switch provides X.25 gateway access to E-mail on the wire-bound networks.

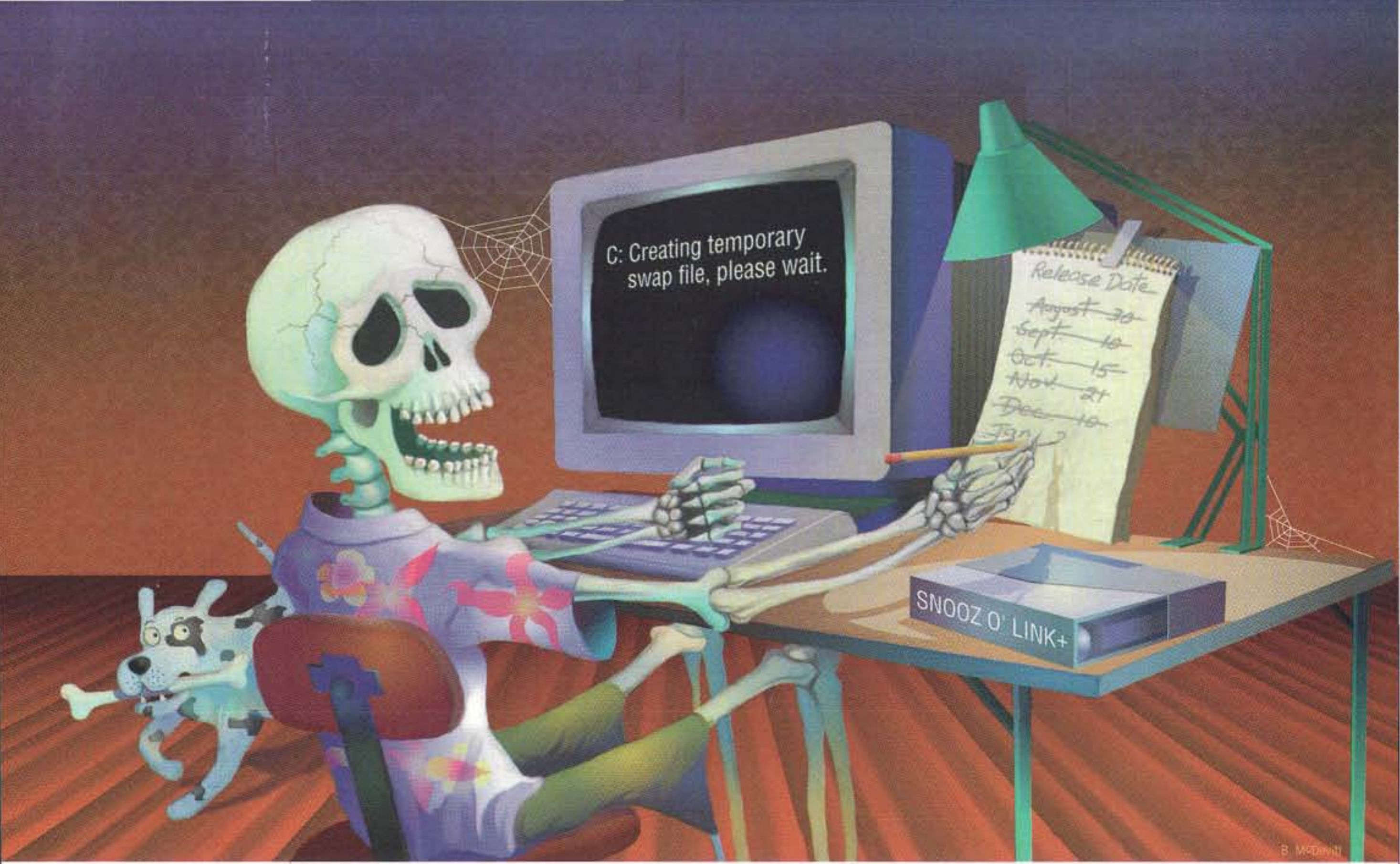
The Pace of Change

The world of wireless data communications is changing at a fantastic pace. Bell Atlantic announced that it will be starting up a trial version of the CDI system in early 1993. In addition to Bell Atlantic's CDI program, the CDPD system is already being tested in Silicon Valley, and the cellular industry hopes to start installing the system elsewhere by the middle of 1993. And the RAM Mobile Data network will have two new base stations installed per week over the next several months, bringing coverage to over 90 percent of the U.S. population.

The market research firm Forrester Research (Cambridge, MA) expects the number of subscribers to wireless networks to reach 2.5 million by 1997. And according to Motorola, the market for wireless E-mail will reach $1 billion by 1996 because of advances in business decentralization and portable computing.

The competition over the next several years will be brutal because the standards will be decided, in a large part, by the companies that ship the most boxes. Most of the technical problems involved with wireless data communications are solved, but the marketing is just beginning. Once the infrastructure is mature, wireless mobile computing will be as painless as dialing a telephone. ■

John P. Mello Jr. is a freelance technology writer based in Woonsocket, Rhode Island. You can reach him on BIX c/o "editors" or on MCI Mail at 264-1102. Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can reach him on BIX as "pwayner."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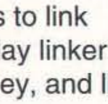

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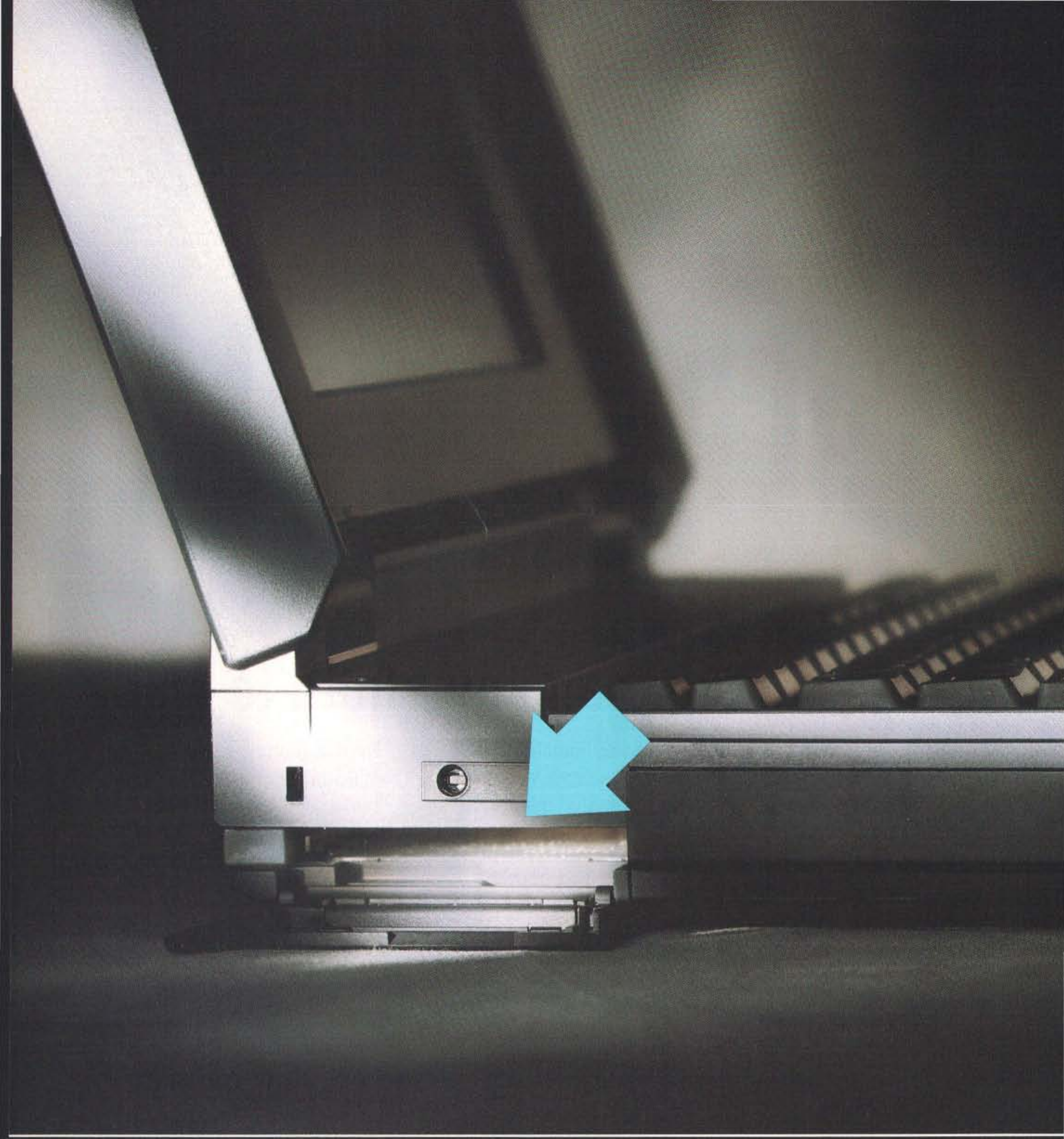

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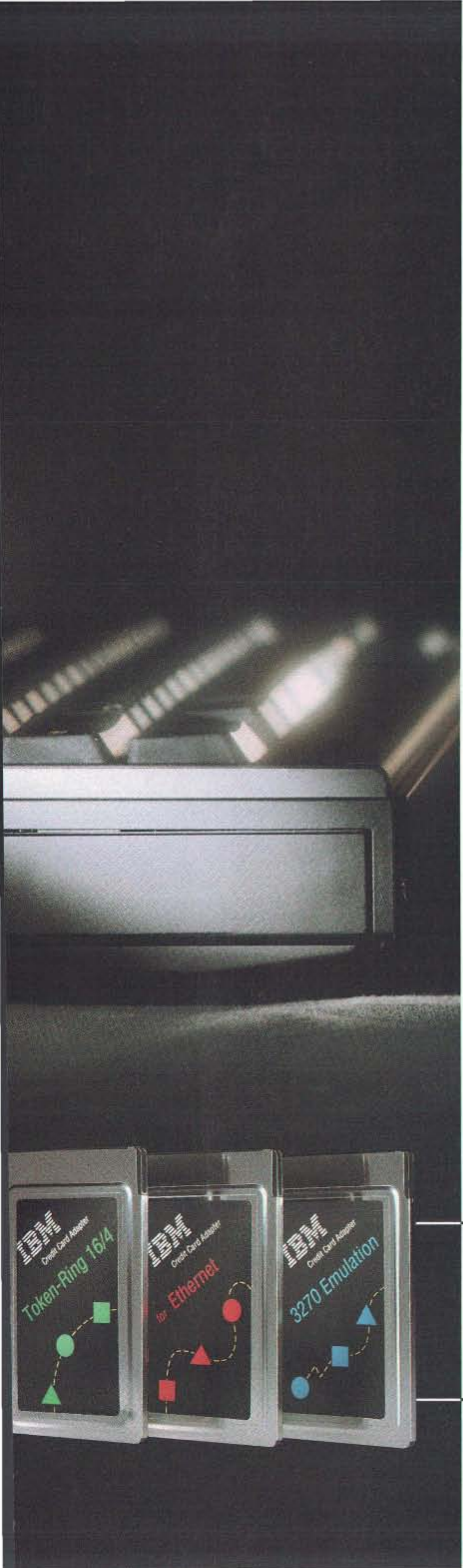

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STRETCHING THE ETHER

How wireless technologies make the most of limited bandwidth

PETER WAYNER

Radio transmission is based on the principle that an accelerating electron creates an electromagnetic field. Such a field accelerates other electrons. Thus, it's possible to move electrons in one place and have the resulting electromagnetic field push electrons in another location. The more electrons you move, the stronger the signal and the farther away it can be detected. All this happens at close to the speed of light.

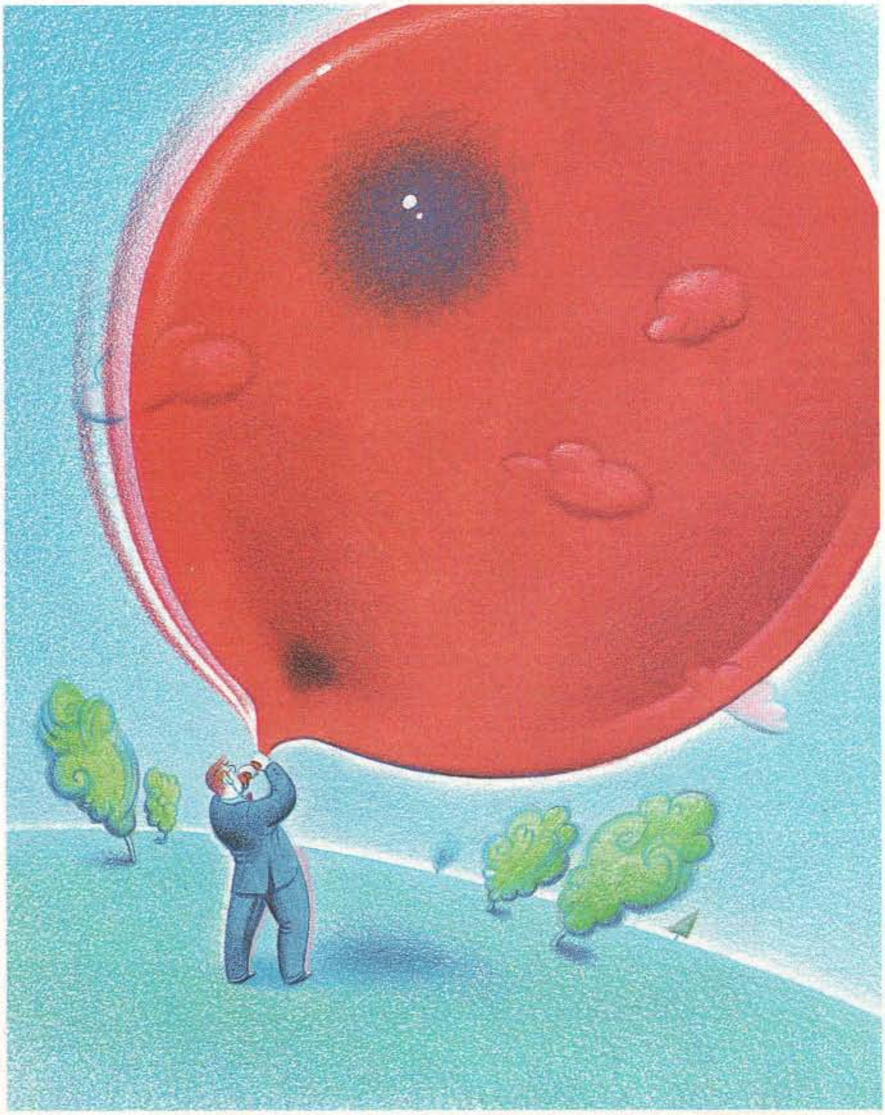
Moving electrons is simple. The trick is to move them in a coordinated fashion. With this capability, you can move information across great distances. And this, in a nutshell, is the basis of wireless data communications.

Radio Waves

The standard approach to radio transmission is to move electrons at a specific frequency and either modulate the strength of the signal (as in AM radio) or make slight changes in the frequency of the signal (as in FM radio). Faster frequencies make it easier to send more information, but faster oscillations require more complicated electronics.

Two signals on the same frequency compete and drown each other out. To avoid this chaos, the FCC allocates parts of the spectrum for specific uses. Early on, TV and radio systems received licenses for their frequencies. The FCC also allocated regions of the spectrum for personal use (e.g., the CB and ham radio bands). But the spectrum is a limited quantity, and the demands of new technologies are putting pressure on the FCC to allocate frequencies to many different groups.

The technical challenge is to pack more users into a narrow band of the spectrum,



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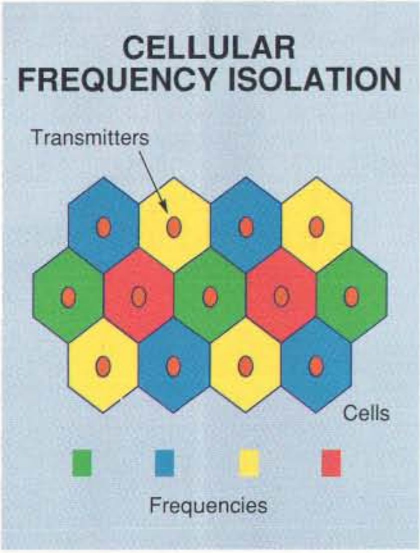

Figure 1: *In cellular transmissions, the same frequencies can't be used in adjacent cells. Frequencies must be isolated to avoid interference.*

and a good example of this is cellular radio. Before the invention of this technology, radio telephone service was expensive and limited because each call took up an entire frequency. Cellular technology works because the system can limit the power of each signal to the minimum amount necessary. This limits interference to a small area around the base station and the portable phone. When you place many antennas around a city, towers in different locations can use the same frequency without experiencing interference.

Cellular Maps

The standard configuration of a cellular telephone system is a grid of hexagonal cells. Initially, a city may have only one cell. When competition for the limited channels becomes too fierce, the cell can be divided into seven smaller hexagonal cells of one-third the radius of the original cell. The subdivision can be repeated, and some companies talk about nanocellular systems that cover an office building with thousands of cells often no more than 3 or 4 feet in diameter. Adjacent cells must use different frequencies, but cells on opposite sides of the grid can use the same frequency without experiencing interference (see figure 1).

The CDPD (cellular digital packet data) system was designed by IBM and the cellular communications companies to provide data communications in the cellular range without impeding voice systems. The system uses telephone channels just as a modem uses a telephone line, but it's nimble enough to jump frequencies when a new telephone call starts in the cell. The system is limited by the number of frequencies available in the cell: When all the frequencies are in use, the network locks out new connections. This all-or-nothing performance is different from the data-only network from RAM Mobile Data (New York, NY), in which the data rate merely slows as more users enter the system and compete for free slots.

It's expensive to subdivide a cell and add new antennas and telephone lines to handle new calls. Another method of increasing the capacity of a system is to turn to digital technologies that can use sophisticated compression techniques. The best digital systems model the human voice box to provide the optimal compression of conversation. Some of the best vocoders (i.e., the compression chips that convert voice to bits) can encode a 30-kHz signal in about 4000 bps.

Once voice signals are converted to bits, there are a number of ways of packing the signals closer together. A system known as TDMA (time division multiple access) is able to place three signals into a channel by interleaving them. Another approach that is being developed by Qualcomm (San Diego, CA), called CDMA (code division multiple access), uses spread-spectrum spreading codes to fit up to 10 times more data into a channel. One frequency can handle several connections at a time (see figure 2).

The CDMA system also includes an improved method of handing off calls between cells. For example, imagine you are cruising along the highway, talking on a frequency, and your car crosses the boundary of the cell. The central station of the

Cellular Transmission

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- lower hardware costs
- lower transmission costs

Packet-Switched Radio Transmission

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- faster
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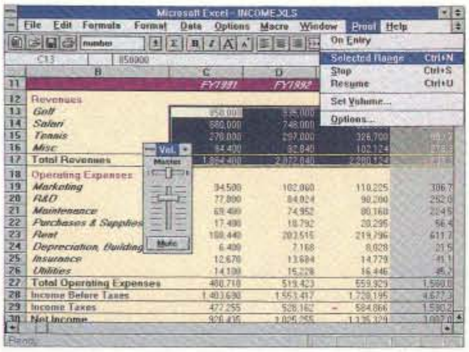

C13 850000

	B	C	D	E	F
11		FY1991	FY1992		
12	Revenues				
13	Golf	850,000	[illegible]		
14	Salari	680,000	748,000		
15	Tennis	270,000	297,000	326,700	
16	Misc	64,400	32,840	102,124	
17	Total Revenues	1,864,400	[illegible]	[illegible]	
18	Operating Expenses				
19	Marketing	94,500	102,060	110,225	306.7
20	R&D	77,000	84,924	90,200	252.0
21	Maintenance	69,400	74,952	80,160	224.5
22	Purchases & Supplies	17,400	18,792	20,295	56.4
23	Rent	188,440	203,515	219,796	611.7
24	Depreciation, Building	6,400	7,168	8,028	21.5
25	Insurance	12,670	13,684	14,779	41.1
26	Utilities	14,100	15,228	16,446	45.2
27	Total Operating Expenses	480,710	519,423	559,929	1,560.0
28	Income Before Taxes	1,403,690	1,553,417	1,728,195	4,677.3
29	Income Taxes	477,255	528,162	584,866	1,590.2
30	Net Income	926,435	1,025,255	1,135,329	1,007.0

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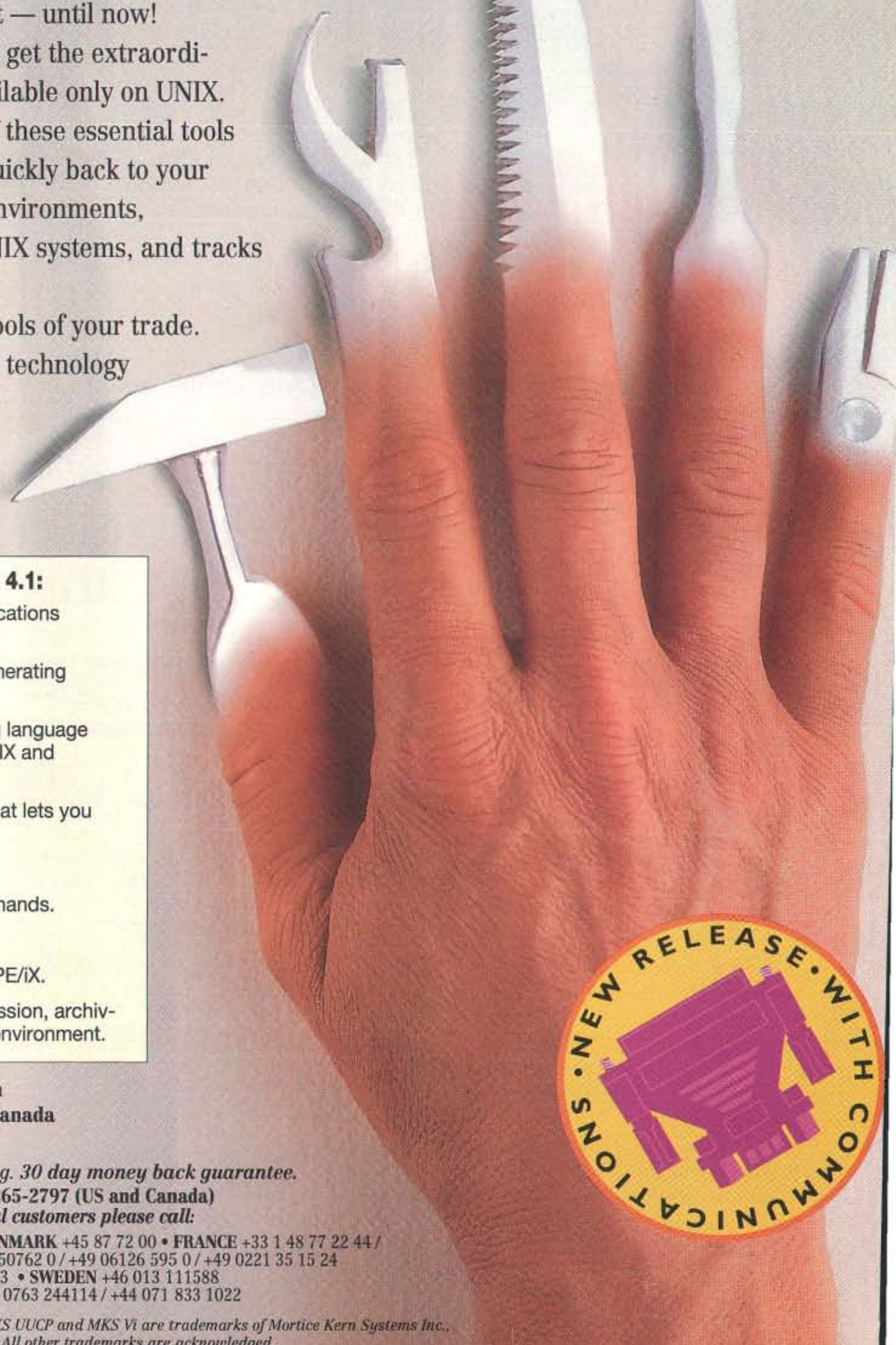

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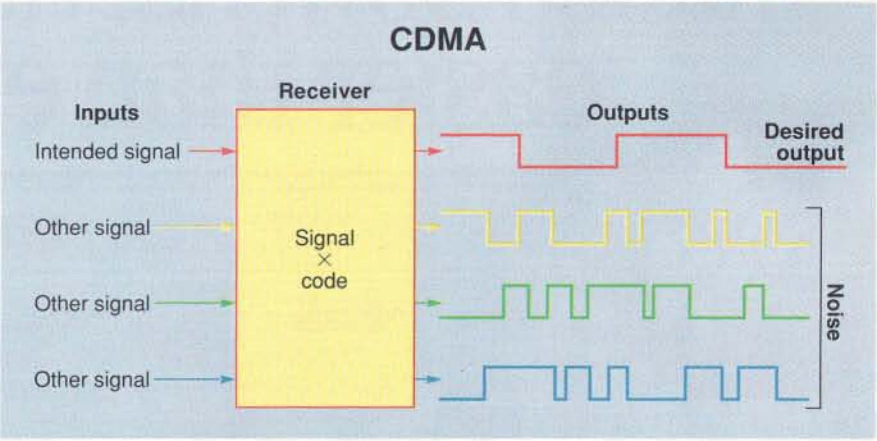

Figure 2: *With CDMA, all users share the same frequency, but each signal is created with a unique code—the spreading code—that replicates the original signal when multiplied by the signal. As long as the receiver uses the same code, only one signal at the receiving end will decode clearly—that is, as something other than noise.*

cell notices this when your signal becomes weaker. It notifies the neighboring cell to pick up your call, and your telephone must switch frequencies.

This isn't much of a problem when you are talking—you might lose a word or two, but humans compensate for this. But data transmissions are less forgiving, and the lost bits can mangle a fax transmission or a database access. CDMA uses a "soft" hand-off system that lets both cells broadcast the same signal at the same time on the same frequency. As the car moves from one cell to another, the strength of the closer signal grows and that of the old one fades. When your car is in the range of the new cell, the old cell's transmitter stops broadcasting your call.

Data-Only Networks

Pure data networks use different methods than cellular networks. RAM Mobile Data's Mobitex system breaks data into packets of information and transmits the packets individually. The first packet contains addressing information and the number of subsequent packets. The other packets contain 48-bit blocks of data and 21 bits of error-correcting information. All the bits form an overdetermined system of linear equations that have 48 unknowns and 69 equations.

Basic algebra is used to detect and fix errors. If one bit is flipped by mistake, the equations will not be consistent, making it possible to identify and correct single-bit and bit-pair errors. The protocol is capable of detecting errors in up to 15 consecutive bits, although there isn't enough information to correct errors this large. In such cases, the receiver can ask that the data be resent.

The RAM Mobile Data Mobitex network requires that every packet be acknowledged. If it's not, the network rebroadcasts the packet until it is successfully received and acknowledged. This redundancy is important when you drive through a tunnel and break the radio connection. But what if the acknowledgment signal from the portable to the base station is mangled? The base station assumes that the packet did not arrive successfully and rebroadcasts it. Suddenly, your machine is flooded with duplicate packets. This can lead to an endless cycle of acknowledgments. The Mobitex system avoids this problem by labeling each packet with a number from 1 to 15. The stations discard packets with identical numbers.

The RAM Mobile Data Mobitex network accommodates the thousands of transmitters that want to communicate with the base station with a procedure called *slotted aloha*. At predetermined intervals, the base station broadcasts a "free" message, which indicates that there will be *n* slots of free airtime of *x* milliseconds apiece available. Computers wait for this message and use an internal pseudorandom number generator to choose one of the *n* slots. The base station puts these contact requests in a queue and deals with them in turn. Collisions between rival computers broadcasting at the same time are minimal as long as enough free messages are broadcast.

The network's protocol ensures that the

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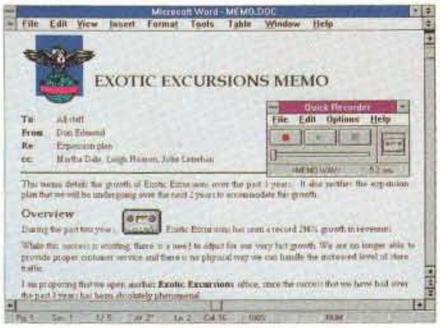
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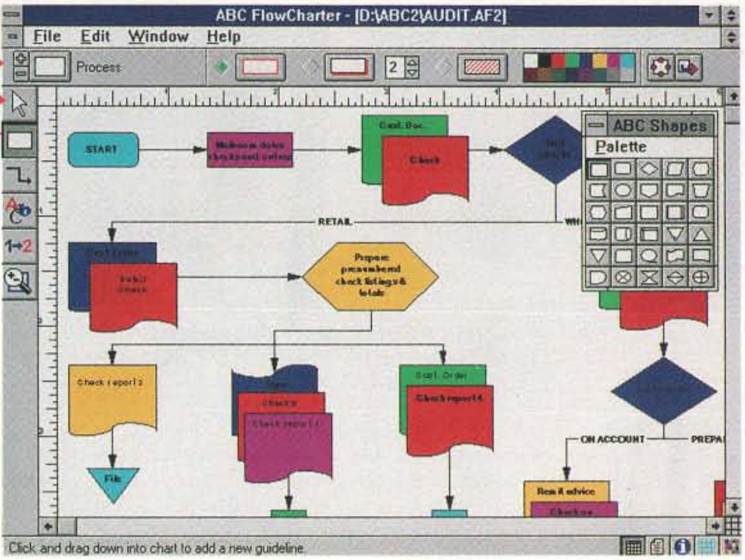

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balance between throughput and free slots can be varied during the day. During periods of high loads, a network might broadcast only a small number of packets before sending a free message to look for new contacts. When the load is low, a network can send many more packets to stations before initiating a free message, because it can be reasonably certain that there will not be many new field units requesting contact.

The Internet Model

A company in California called Tetherless Access, Ltd., is designing a system to link all the computers in a metropolis into a wireless network. The big difference between this vision and that of other networks is that here the computers organize themselves; there is no company controlling the system and taking a few pennies for every squirt of data that is sent over the airwaves.

The basic principle of the TAL network is that each computer routes every packet that comes its way that isn't addressed to it. When a computer wants to send a message, it simply broadcasts the packet with the address, and the other computers in the network repeat the message until it arrives at its destination.

This would seem like a pipedream if it were not for the fact that several networks already operate like this. The computers on the Fidonet and the Internet rely on their neighbors to pass on E-mail, news articles, and other messages. The catch is that the Internet and the Fidonet use the telephone system for packet trading. The TAL network does not need this infrastructure, because the air is still free—although in limited quantities (the FCC allows unlicensed broadcast on only a few small bands).

Overcoming the Odds

A number of technical problems stand in the way of the success of the TAL idea; however, they are not insurmountable. The biggest one is cooperation. All the computers and their transmitters must ensure that they don't step on a signal of another system. Protocols must be designed so that a computer uses the minimum amount of power necessary to reach its neighbors—more power disturbs more people. And the system must design routing networks to make sure that messages are not replicated or sent throughout the network, adding clutter.

Each of these problems has been solved in the laboratory, and it's only a matter of time before networks like TAL's are available to the public. In the meantime, the WINForum (Wireless Information Networks Forum) is developing etiquettes for the PCS bands.

There are even more fundamental limitations to a network like the one proposed by TAL, though. The bandwidth of the radio spectrum is more limited than the bandwidth of wires and fiber-optic cables. Telephone companies are already proposing test systems that will allow each home to receive video on demand. The airwaves cannot begin to approach this level of information flux.

TAL has a bigger dream of putting a transceiver on every home.

TAL is already setting up a test network for the San Diego library system, using Macs donated by Apple Computer's Libraries of the Future program. It's also starting a larger test-bed in the San Francisco Bay area that will offer a wide range of options. And the company is investigating building networks, linking some of the U.S. Army's Defense Technical Information Centers around the country. These projects will test the ability of computers to cooperate.

Many other companies are bound to address the same questions; however most are limiting their focus to offices. But TAL has a bigger dream of putting a transceiver on every home and letting a network grow around the country. The biggest obstacle is getting enough of the spectrum and developing the momentum to accomplish the task. If the FCC allocates part of the spectrum for these populist data networks and promulgates the necessary rules for its use, TAL may see a shining, wireless network evolve. ■

Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can contact him on BIX as "pwayner."

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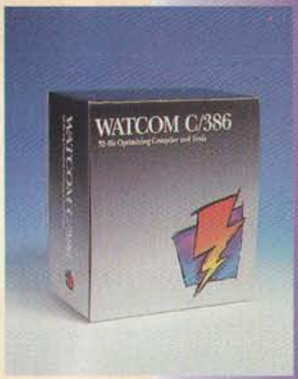

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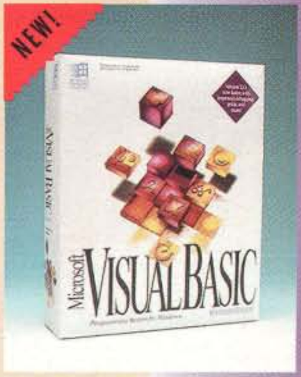

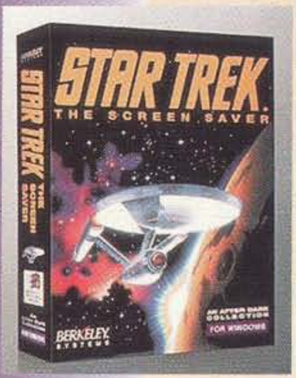

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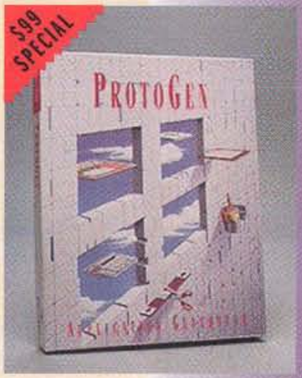

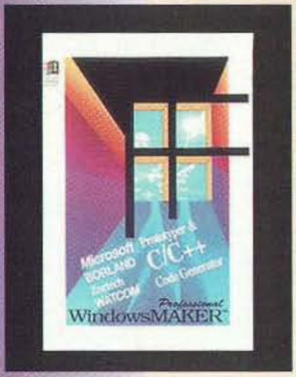

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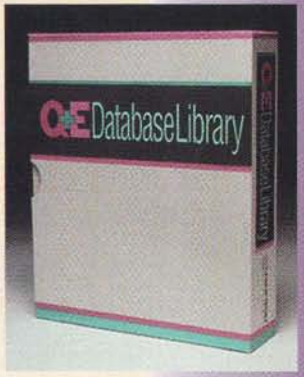

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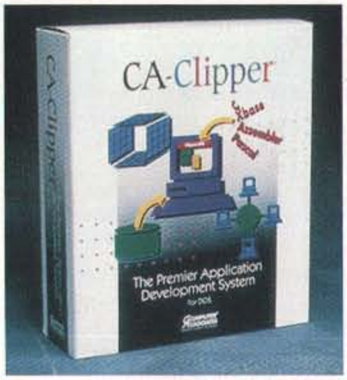

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COMMUNICATIONS GET PERSONAL

AT&T unveils its plans for the personal communications revolution

BOB RYAN

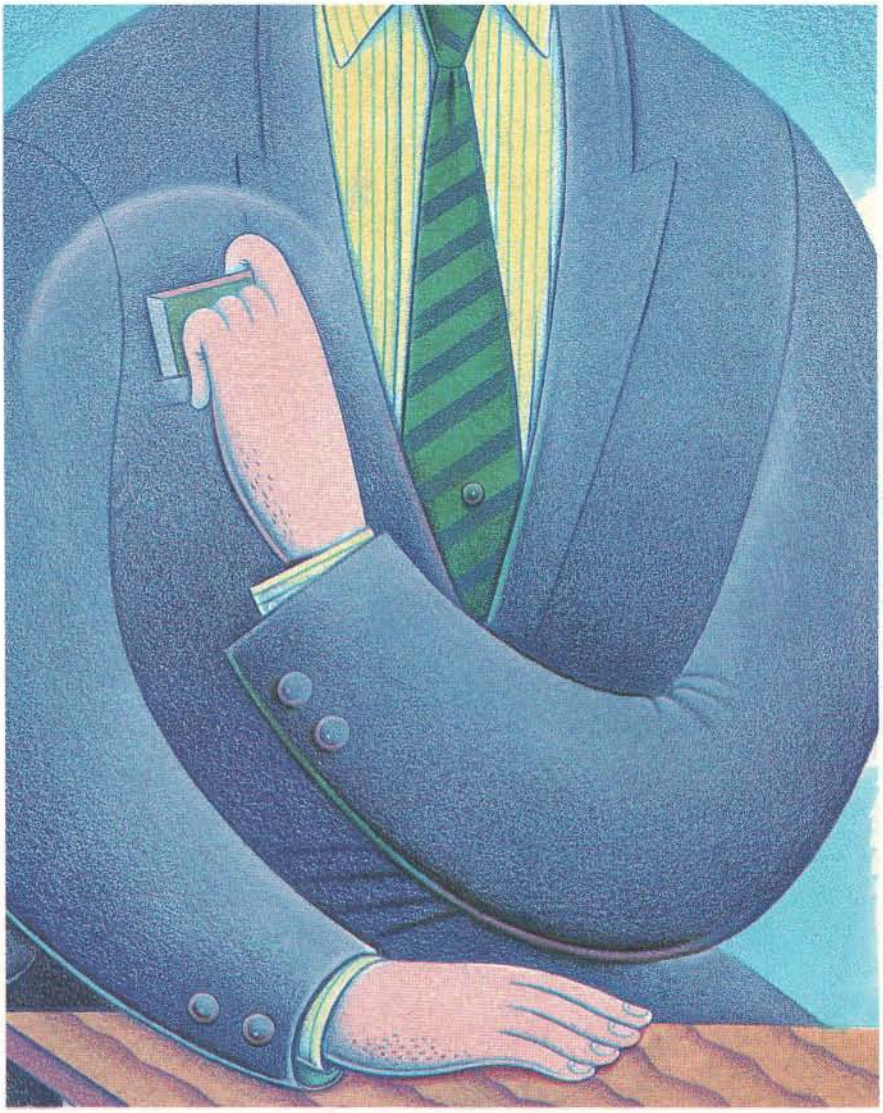
Hand-held systems such as Apple's Newton are advancing a vision of computing that sees the personal computer not as a miniature mainframe but as an intelligent, highly sophisticated personal communications device. Behind this view are a number of technologies—wireless communications, low-power processors, object orientation, and advanced integration—that are falling into place. Also important is the realization that these machines don't have to be compatible with desktop computers: They just have to be able to communicate with them.

With a personal communications device, you carry the computer and communications services (or your connections to them) in your pocket. The Newton made its big splash last summer (see the text box "Apple's PDA Vision" on page 170). Now AT&T—Apple's former partner in developing a low-power processor—has weighed in with its own vision of the future of personal communications.

The Computer as a Telephone

In conjunction with Go Corp., AT&T has recently entered the personal communications arena in a big way. AT&T and Go hope to establish their view of personal communicators as a standard platform for personal communications devices.

As you might expect, AT&T takes a slightly different approach to personal communications devices than does Apple. According to Rakesh Sood, director of marketing of personal communications systems for AT&T Microelectronics, the AT&T-Go initiative takes as much or more of its content from the telephone as it does from the computer: "The primary application is personal messaging, such as fax,



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Apple's PDA Vision

Last summer, Apple Computer announced the Newton (see photo A), a pen-based system weighing less than a pound and designed to go anywhere that you do (see "The PC Gets More Personal," July 1992 BYTE). Dubbed a PDA (Personal Digital Assistant), the Newton features a low-power, high-speed RISC processor; a 32-bit multitasking operating system; and Intelligent Assistant software.

Intelligent Assistant performs complex tasks based on your pen input. For example, if you tell it to send E-mail to Susan, it would get Susan's E-mail address from your computerized Rolodex, construct the message with the proper headers, and then transmit the message if you have a connection or defer transmission until you connect the Newton to a wired or wireless communications service.

When it ships early this year, the Newton will offer limited communications capabilities. Using a built-in infrared link, you will be able to connect two Newtons or link a Newton to an AppleTalk network. In addition, the Newton will have a wired link that will enable it to exchange data with Macs as well as PCs.

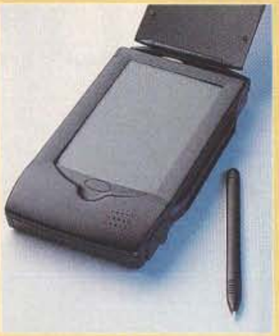


Photo A: *Apple's Newton.*

The limitations of the Newton's initial communications capabilities are related to infrared technology. Infrared communications are *line-of-sight*—that is, you have to be able to see the receiver to make and maintain a connection. Also, infrared communications are susceptible to interference from rain, snow, and smog, making them short-range.

Apple is well aware of the limitations imposed by using infrared technology in PDAs and is pushing into the realm of radio-based wireless communications (see "Stretching the Ether" on page 159). In fact, Apple's objective is to make it possible for a PDA to establish a digital connection to another computer from any location on earth. Only then will the promise of the Newton truly be fulfilled.

E-mail, and voice. Voice is a critical component." AT&T set out to create a platform that could handle all types of messaging, from paging to voice mail. The result is the personal communicator.

For the joint initiative, AT&T supplies the basic hardware components; a processor and support chips designed for high-speed, low-power operation; and some custom chips that support modem and voice applications. Go supplies the system software—a version of its PenPoint operating system written for the AT&T processor.

PenPoint is a 32-bit, object-oriented, multitasking operating system built from the ground up to support pen-based computing (see "The Point of the Pen," February 1991 BYTE). Because PenPoint is object-oriented, a PenPoint application has access to the operating system's code and to the code of other applications. This code sharing is critical to personal communicators, because it cuts down on memory requirements, which in turn reduces the size and power requirements of a system.

PenPoint's design is tailored for communications. Support for immediate and deferred communications is built into the operating system.

Even though PenPoint is a known quantity with a small but growing software base, the hardware side of the personal-communicator equation is new. At its heart lies the Hobbit, a new, low-power, high-performance processor from AT&T.

A Processor for C

The Hobbit (which was formerly called the ATT92010) grew out of Bell Labs' efforts to develop a computer architecture to complement the C programming language. Dubbed CRISP (C Rational Instruction Set Processor), the architecture was originally designed to optimize the performance of programs written and compiled in C. The first silicon implementation of CRISP came in 1986, and development has continued ever since. But in the past few years, the CRISP design specification has been expanded to include low-power performance. The ATT92010 is the first commercial manifestation of the CRISP architecture.

The Hobbit's Key Features

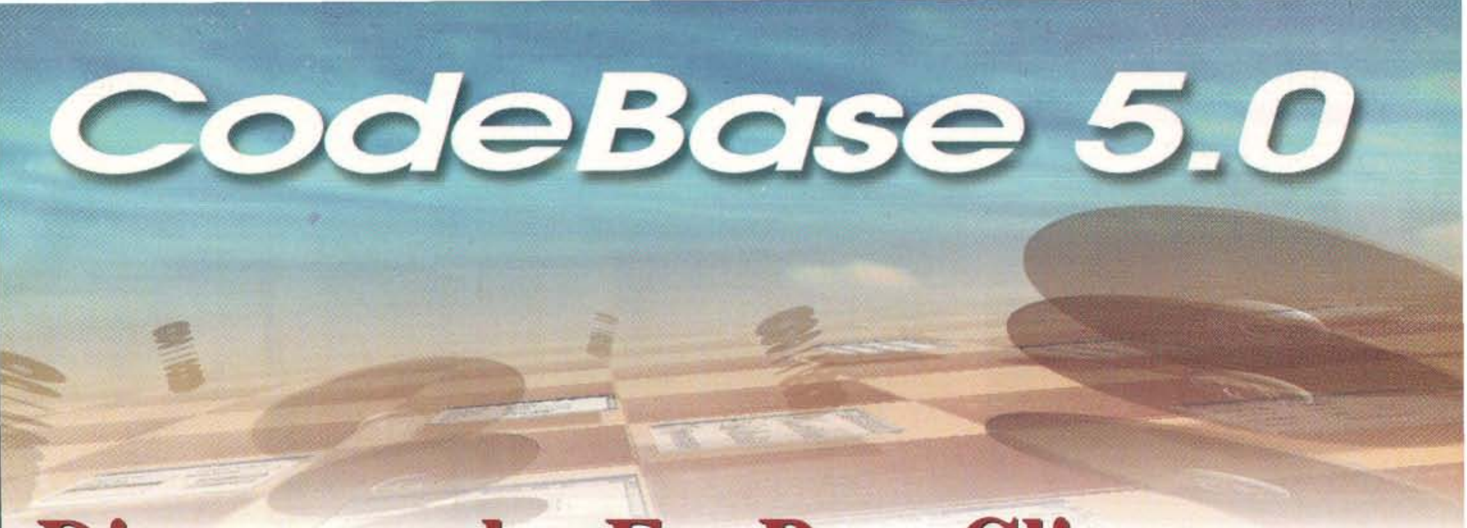
- optimized for C
- memory-to-memory architecture
- two independent three-stage pipelines
- branch folding

Beyond the fact that it's a 32-bit microprocessor fabricated with a 0.9-micron double-metal CMOS process, the Hobbit bears little resemblance to the RISC and CISC processors that dominate desktop computing. Most processors—including all RISC and CISC chips—use a register-to-memory architecture. The processor loads an operand into a register before acting on it with an instruction. After processing, the result—usually a modified operand—is written from the register back to memory. The Hobbit, on the other hand, uses a memory-to-memory architecture. This means that it has no registers that are directly accessible to a programmer.

Caching the Stack

Early on in the development of CRISP, AT&T researchers found that roughly 5 percent of all C language instructions were either procedure calls or returns and that nearly half the execution time of register-oriented machines involved procedure-call overhead. Beyond this overhead, most instructions were simple, with branching instructions being the most common. These facts shaped the design of CRISP: A C-rational processor had to have low procedure-call overhead and a reduced penalty for branches.

While an operand stored in a register can be accessed at least an order of magnitude



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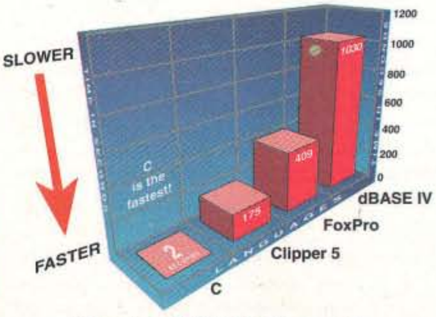

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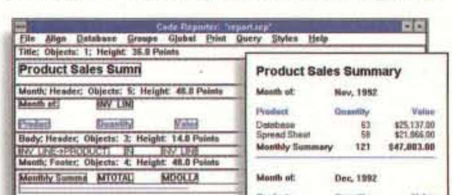
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Monthly Summary	**121**	**$47,003.00**

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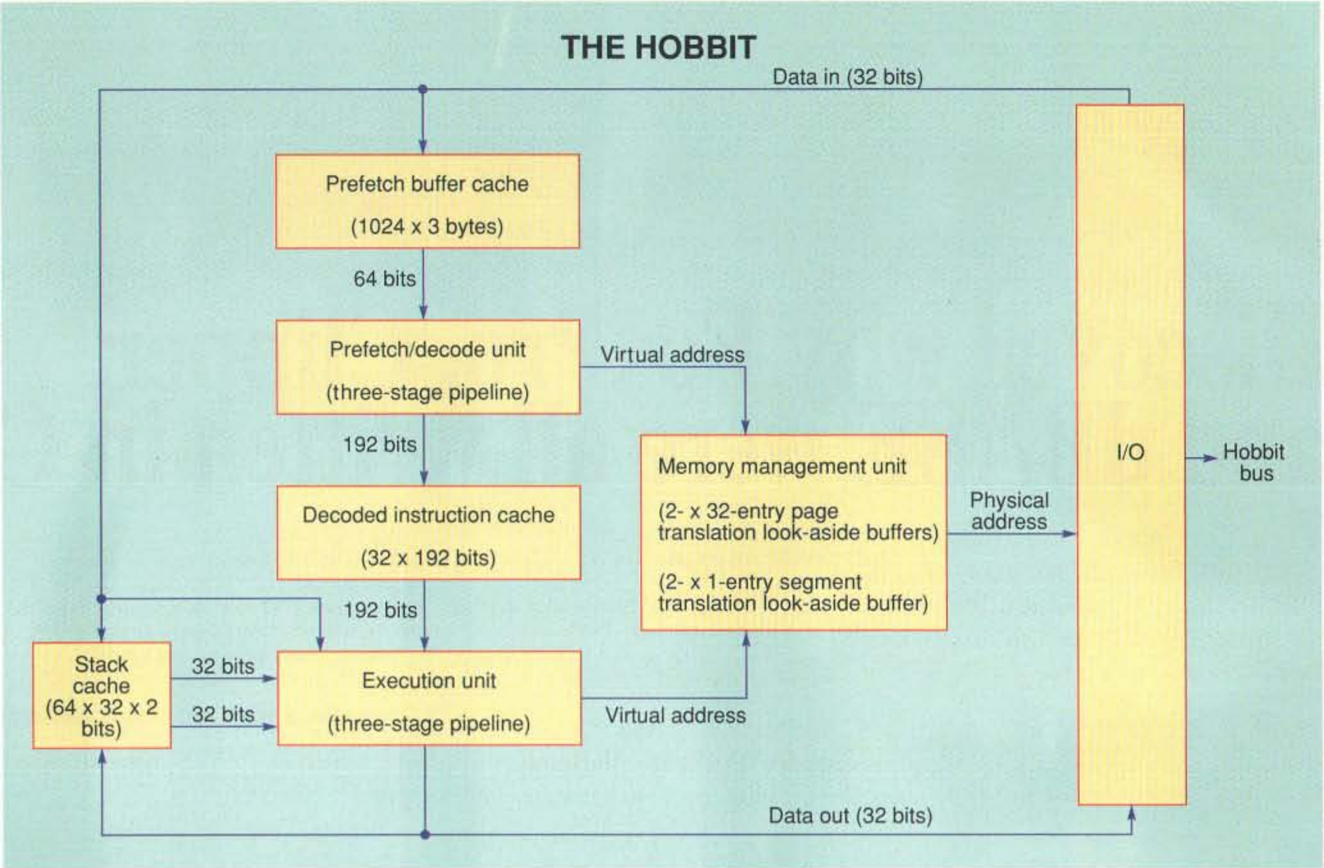

Figure 1: *The primary execution pathway in the Hobbit consists of two three-stage pipelines coupled by a cache. The prefetch/decode unit transforms instructions into the 192-bit format that the execution unit requires. The execution unit determines addresses, fetches operands, and computes and stores results. If an operand is in the stack cache, it's available to the pipeline without delay. (Courtesy of AT&T Microelectronics)*

faster than one stored off-chip, registers are big contributors to procedure-call overhead because their state must be saved across such calls. Thus, for a C-rational processor, general-purpose registers just didn't make sense.

The Hobbit avoids the drawbacks of general-purpose registers by using an on-chip 256-byte stack cache for fast processor access to operands. The top of the user stack is on-chip, greatly reducing the overhead required to perform procedure calls and returns, which normally store parameters on the stack. A standard processor would have to store one set of parameters from registers to the stack and load a second set from the stack whenever a program initiated a procedure call. The stack cache eliminates these loads and stores.

The stack cache is organized into a circular buffer of 64 32-bit hardware registers. It's as fast as a general-purpose register file, but like a cache, it resides logically in the system memory-address space. The stack cache is transparent to software, so its size can be increased in future versions of the Hobbit without sacrificing software compatibility.

Hobbit Plumbing

Its lack of general-purpose registers aside, the Hobbit borrows features of its design from both the CISC and RISC architectures. Like CISC processors, its instruction set supports multiple addressing modes, and individual instructions can access up to 2½ memory locations—two memory-based operand reads and a write to the accumulator. Such complex, variable-length instructions permit higher code density than RISC processors, an important consideration when you're coming up with a processor for portable devices.

From the RISC world, the Hobbit borrows pipelines. The core of the Hobbit consists of two independent three-stage pipelines: a prefetch/decode unit and an execution unit (see figure 1). The latter is loosely coupled to the former by a decoded instruction cache. The prefetch/decode unit takes instructions from the prefetch buffer cache and decodes them into 192-bit instructions for the execution unit. The execution unit reads decoded instructions from the decoded instruction cache, retrieves the necessary operands from the stack cache or from off-chip, and stores the result.

Pipelines work best when the flow of a program is linear, but such is not the case with C programs. Early in the CRISP project, AT&T discovered that up to one-third of all instructions in C programs run on VAXes were branching instructions (the VAX was used as a benchmark because, unlike load/store machines, it uses complex, multioperand instructions). A mechanism was needed to deal with all the branch instructions that the Hobbit would be faced with.

To do this, AT&T uses *branch folding*. Every instruction in the decoded instruction cache contains two 32-bit fields that can hold the addresses of possible successor instructions. The logic to calculate these addresses is located on the input side of the decoded instruction cache. Thus, every instruction placed in the cache is a

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branch instruction, because it contains the addresses of all possible follow-on instructions. If during instruction decoding a nonbranching instruction is followed by a branching one, the two are "folded" into a single instruction in the decoded cache.

The execution unit consists of an effective-address calculation stage; an operand-fetch stage; and an execution stage, where the operands move through the ALU and the results are stored to the stack cache or to memory. In the final stage, four comparators check the destination address of the executing instruction against the addresses of the operands of the instructions in the first two stages of the pipeline.

If the destination address is accessed by one of the two following instructions, the computed value is passed from the ALU back to the correct stage in the pipeline, satisfying the data dependency without stalling the pipeline. AT&T calls this procedure *read canceling*, because the presence of the passed-back value eliminates the need for a follow-on instruction to perform a read to acquire the operand (see figure 2).

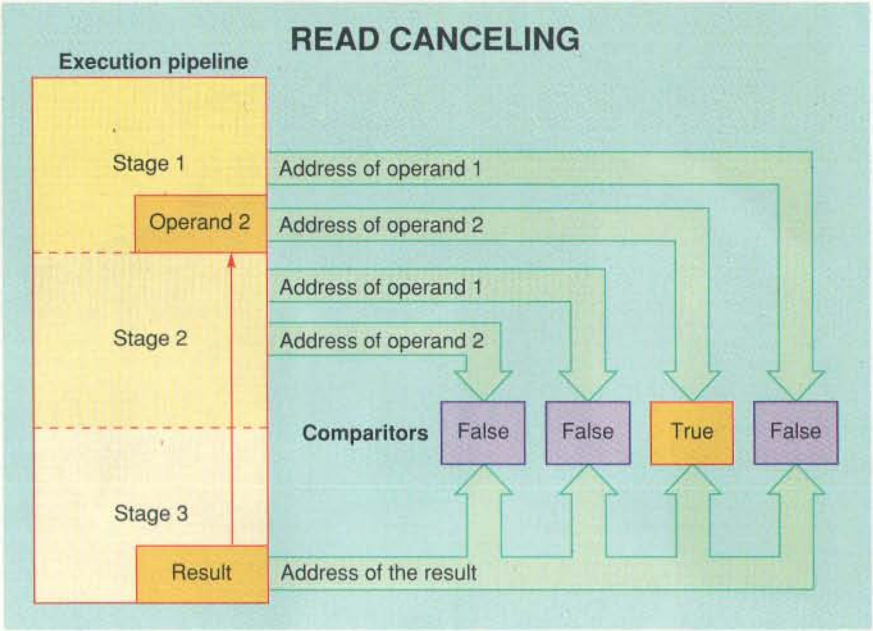

Figure 2: *To deal with data dependencies that would normally stall a pipeline, AT&T uses four comparitors that check the address of the result of the instruction in stage 3 with the address of the operands of the instructions in stages 1 and 2. If a comparitor finds a match, the result from stage 3 is passed to the appropriate instruction in the pipeline, eliminating the need for that instruction to read the operand address. In effect, a pipeline hazard can give the Hobbit a performance boost.*

Sweating the Details

With the stack cache limiting off-chip accesses, which reduces power consumption, and with the instruction unit using complex instructions, which results in denser code and smaller memories, the Hobbit is well served by its architecture as a processor for low-power, small-form-factor computing devices. It's also well served by its design and the way it's manufactured.

AT&T uses a CMOS process to fabricate the Hobbit, resulting in low power consumption—250 milliwatts at 20 MHz and 3.3 V. The Hobbit also features a stoppable clock that reduces power consumption when the processor is within a range of from the standby mode to 50 microwatts. Finally, the integration of the instruction prefetch buffer, the stack cache, and the memory management unit on the 0.92cm^2 chip lowers the chip count and power requirements of Hobbit-based devices.

Despite its low power consumption, the Hobbit is no performance slouch. In benchmarks that AT&T released at last fall's Microprocessor Forum, it outperformed Intel's low-power 386SL by a factor of three, using less than one-quarter of the power. Its performance is similar to that of the ARM610 used in the Newton, and it uses less power. At 20 MHz, the Hobbit puts out about 13.5 VAX MIPS.

The Hobbit can run at 5 V or 3.3 V, so it can use today's numerous 5-V peripherals or tomorrow's 3-V devices. It can even use lower voltages. AT&T expects the chip to sell for about $35 in quantity.

The Supporting Cast

The Hobbit is the centerpiece of a new family of chips from AT&T designed for use in personal communicators. Other members of the family are the ATT92011 SMD (System Management Device), the ATT92012 PCMCIA Interface Device, the ATT92013 P-ISA Interface Device, and the ATT92014 Display Controller. All these PCS (personal communication services) devices can interface with the Hobbit, run at 3.3 V or 5 V, and provide 3.3- to 5-V translation.

The SMD handles bus arbitration and power management; generates the system clocks; and contains an asynchronous serial port, a keyboard/pen port, 256 bytes of battery-backed SRAM (static RAM), and a real-time clock. The SMD's power management functions are impressive: It can selectively shut down parts of the system (including the Hobbit) that aren't in use or shut down the entire system (including itself) until it receives an interrupt from the real-time clock or gets an on/off signal. The SMD can also refresh DRAM during a shutdown.

The other three PCS devices control communications with peripherals. The P-ISA Interface Device provides a connection between the Hobbit CPU bus and a peripheral bus that is a subset of the ISA bus. This subset doesn't support bus masters and limits DMA and interrupt functions. The PCMCIA controller handles connections to three PCMCIA slots. The controller supports PCMCIA 2.0.

The video display controller lets the Hobbit drive color and gray-scale LCDs. It supports three display sizes—640 by 240, 640 by 480, and 1024 by 768 pixels—and up to nine gray levels. The top gray level is used to display the ink of a pen-input device. The controller also has built-in support for 17 dither patterns (16 for the display plus one for ink). Color displays are able to use nine color patterns out of a palette of nearly 5000 patterns. The controller can also drive CRT displays using an external RAMDAC.

Moving Targets

With this foundation, AT&T hopes to create a dynamic environment for independent software vendors and OEMs. Development systems and software development tools have been available since last year. AT&T anticipates that a wide range of systems will be designed around the base platform and that systems will become less expensive and more capable.

Over the next few years, AT&T will concentrate much of its effort toward integrating the functions of the Hobbit support chips onto the same die as a processor. In addition, communications, compression,

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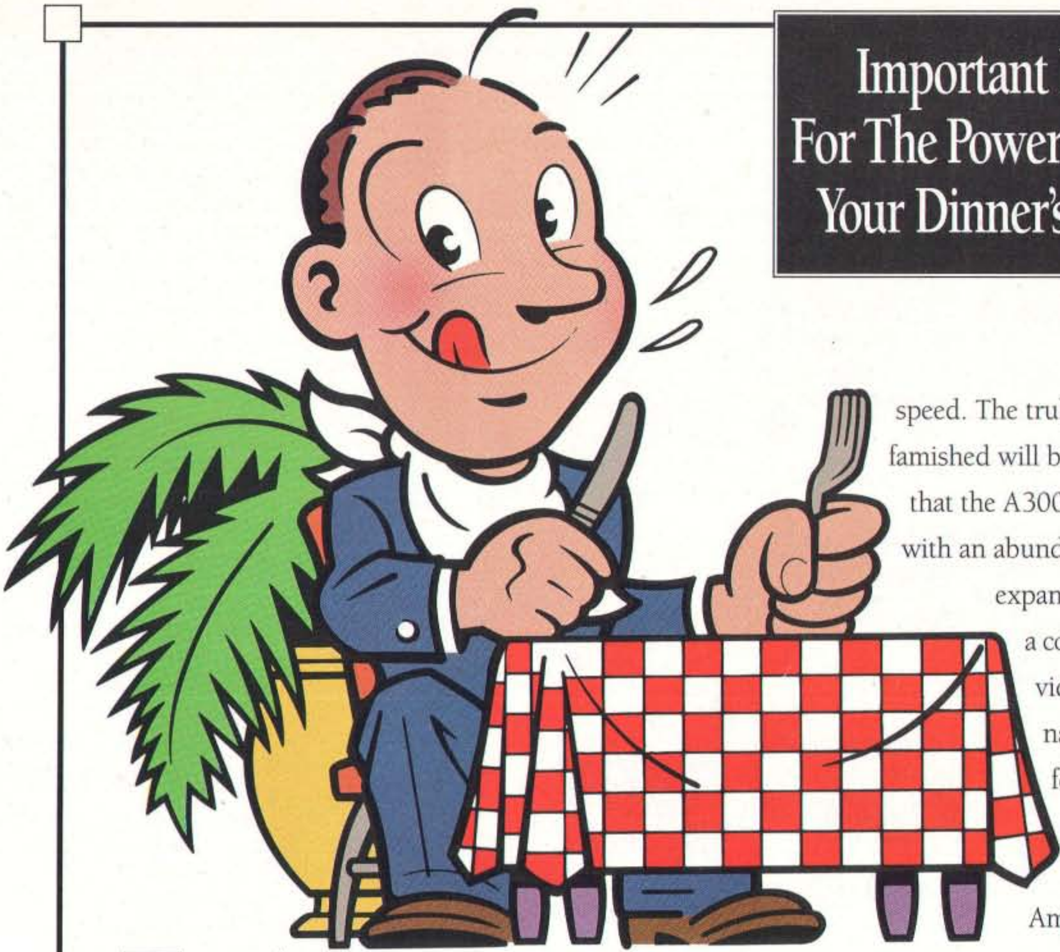

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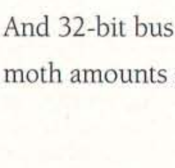

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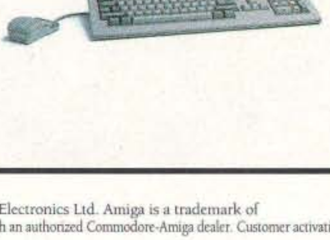

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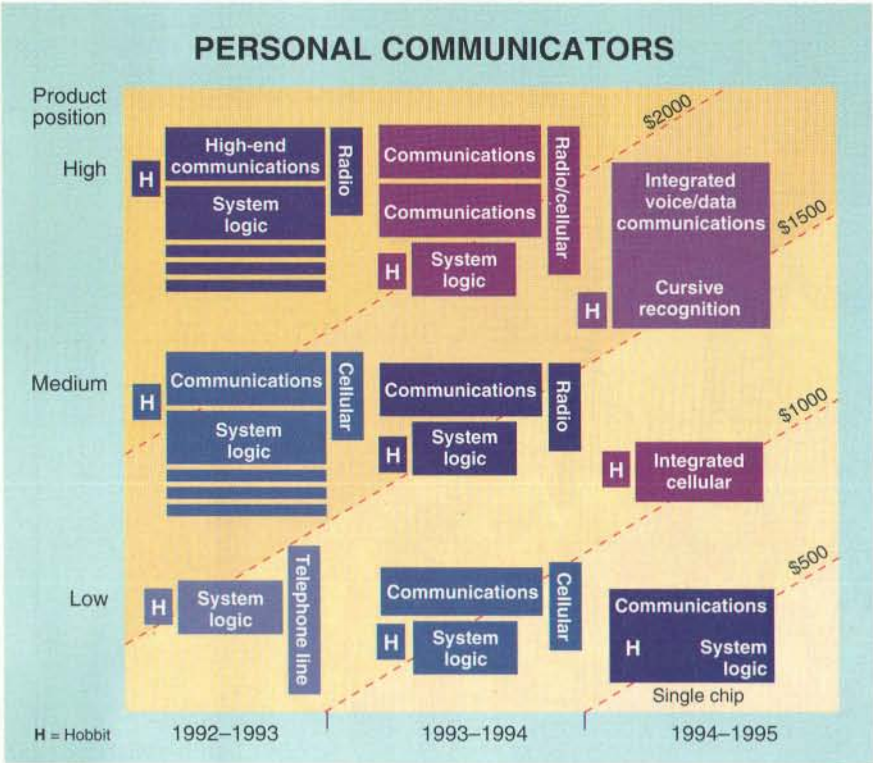

Figure 3: *AT&T expects that the effects of integration and market forces will make this year's high-end personal communicators the low-end systems of 1995. (Courtesy of AT&T Microelectronics)*

handwriting recognition, and other custom functions could also be integrated onto the processor chip (see figure 3).

Offerings from OEMs are scarce. But EO (Mountain View, CA) plans to ship two personal communications systems—the 440 and 880—by the time you read this.

The 440 is a tablet measuring 7.1 by 10.8 inches and weighing, in the basic configuration, 2.2 pounds (see photo 1). It uses a 20-MHz Hobbit and comes with 4 MB of RAM and 8 MB of ROM. All software is in ROM. The 440 has a PCMCIA Type 2 slot for expansion; a microphone and speaker for voice annotation; and serial, parallel, keyboard/pen, and phone ports for communications. One option you can add is a V.32bis data modem, which gives you 14.4-Kbps data transmissions and 9600-Kbps send/receive fax capabilities. You can also add 8 MB of RAM to the system and a 20-MB Hewlett-Packard Kittyhawk 1.3-inch hard drive.

The 880 is larger than the 440, measuring 9 by 13 inches, with a 5.7- by 7.6-inch backlit display that weighs 4 pounds. In addition to the standard features found in the 440, the 880 offers an internal modem and VGA and SCSI-2 ports. The optional hard drive for the 880 is a 1.8-inch IDE unit.

In addition to the PenPoint operating system, the 8 MB of ROM contains PenSoft's Perspective, a personal information manager; Go Fax and Go Mail, from Go; PenTops from Sitka; and several utilities. The package also includes a subscription to AT&T Mail. Both the 440 and the 880 can be outfitted with optional cellular adapters and cellular phones. The basic price for the 440 is $1999; the 880 costs $2999.

The EO systems are significant not only for the capabilities they offer but for the direction they take. Serious communications capability is built into every system, and wireless communications—in the form of analog cellular—and voice are options. As the technologies mature, you can expect these capabilities to be incorporated into the base system and that EO or third parties will offer digital cellular and packet-switched radio options for the machines. In addition, battery performance will improve dramatically as more 3-V peripherals become available. Although the core and memory of the 440 and the 880 operate at 3 V, most of the peripherals operate at 5 V.

Photo 1: *The EO 440's screen is a standard 640- by 480-pixel VGA display with 110-dot-per-inch resolution. Shown is the optional CellPhone module, which lets the internal modem work over the cellular telephone system.*

There and Back Again

AT&T's personal communicator is a bold attempt to bring the power of computers to bear in personal communications. As with any new technology, the first year or so will see trade-offs, as manufacturers try to balance the conflicting needs of portability and advanced communications capabilities.

As digital-cellular and packet-switched-radio technologies mature and more 3-V peripherals become available, the conflicts between portability and capability will lessen, and personal communicator systems will provide both qualities. The changes that they will bring to the way you work and play cannot be predicted, but they will be impossible to ignore. ■

Bob Ryan is a BYTE technical editor. You can reach him on BIX as "b.ryan."

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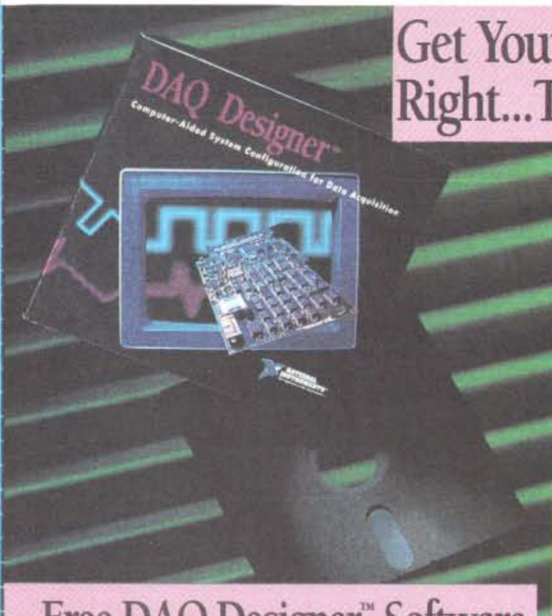

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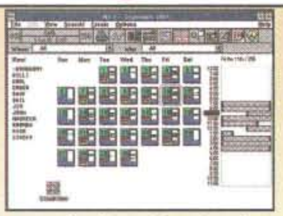

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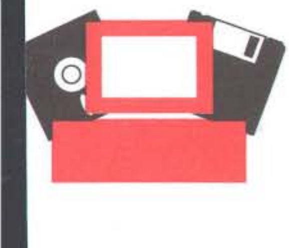
Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!



BYTE

Yes, I want FREE information on the following products!

Fill out this coupon carefully. *Please Print.*

Name

Title

Company

Address

City Country Code

Phone Fax

A. What is your primary job function/principal area of responsibility? (Check one)

1 ☐ MIS/DIP
2 ☐ Programmer/Systems Analyst
3 ☐ Adminstration/Management
4 ☐ Sales/Marketing
5 ☐ Engineer/Scientist
6 ☐ Other

B. What is your level of management responsibility?

7 ☐ Senior-level 9 ☐ Professional
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)

12 ☐ PC/MS-DOS 15 ☐ Unix
13 ☐ DOS + Windows 16 ☐ MacOS
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

18 ☐ 1-25 20 ☐ 51-99
19 ☐ 26-50 21 ☐ 100 or more

February 1993 *90 96 98*

Product Category Information

Circle the numbers below for information on the entire category of products you're interested in.

Hardware	
Accessories/Supplies	1
Add-in Boards	2
Bar Coding	3
Communications/Networking	4
Computer Systems	5
Data Acquisition	6
Disks & Optical Drives	7
Diskettes/Duplicators	8
Fax Boards/Machines	9
Graphics Tablets/Mice/ Pen Input	10
Keyboards	11
LAN Hardware	12
Laptops & Notebooks	13
Mail Order	14
Memory/Chips/Upgrades	15
Miscellaneous Hardware	16
Modems/Multiplexors	17
Monitors & Terminals	18
Multimedia	19
Printers/Plotters	20
Programmable Hardware	21
Scanners/OCR/Digitizers	22
Tape Drives	23
UPS	24
Software	
Business	25
CAD/CAM	26
Communications/Networking	27
Data Acquisition	28
Database	29
Educational	30
Engineering/Scientific	31
Entertainment	32
Graphics	33
Macintosh	34
Mail Order	35
Mathematical/Statistical	36
Miscellaneous Software	37
On-Line Services	38
Operating Systems	39
Programming Languages/ Tools	40
Security	41
Shareware	42
Software Duplication	43
Spreadsheets	44
Unix	45
Utilities	46
Windows	47
Word Processing	48
General	
Books/Publications	49
Recruitment	50
Miscellaneous	51

Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	260	285	310	335	360	385
236	261	286	311	336	361	386
237	262	287	312	337	362	387
238	263	288	313	338	363	388
239	264	289	314	339	364	389
240	265	290	315	340	365	390
241	266	291	316	341	366	391
242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
253	278	303	328	353	378	403
254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

Inquiry Numbers 591-765

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764
615	640	665	690	715	740	765

Inquiry Numbers 948-1122

948	973	998	1023	1048	1073	1098
949	974	999	1024	1049	1074	1099
950	975	1000	1025	1050	1075	1100
951	976	1001	1026	1051	1076	1101
952	977	1002	1027	1052	1077	1102
953	978	1003	1028	1053	1078	1103
954	979	1004	1029	1054	1079	1104
955	980	1005	1030	1055	1080	1105
956	981	1006	1031	1056	1081	1106
957	982	1007	1032	1057	1082	1107
958	983	1008	1033	1058	1083	1108
959	984	1009	1034	1059	1084	1109
960	985	1010	1035	1060	1085	1110
961	986	1011	1036	1061	1086	1111
962	987	1012	1037	1062	1087	1112
963	988	1013	1038	1063	1088	1113
964	989	1014	1039	1064	1089	1114
965	990	1015	1040	1065	1090	1115
966	991	1016	1041	1066	1091	1116
967	992	1017	1042	1067	1092	1117
968	993	1018	1043	1068	1093	1118
969	994	1019	1044	1069	1094	1119
970	995	1020	1045	1070	1095	1120
971	996	1021	1046	1071	1096	1121
972	997	1022	1047	1072	1097	1122

Inquiry Numbers 1305-1479

1305	1330	1355	1380	1405	1430	1455
1306	1331	1356	1381	1406	1431	1456
1307	1332	1357	1382	1407	1432	1457
1308	1333	1358	1383	1408	1433	1458
1309	1334	1359	1384	1409	1434	1459
1310	1335	1360	1385	1410	1435	1460
1311	1336	1361	1386	1411	1436	1461
1312	1337	1362	1387	1412	1437	1462
1313	1338	1363	1388	1413	1438	1463
1314	1339	1364	1389	1414	1439	1464
1315	1340	1365	1390	1415	1440	1465
1316	1341	1366	1391	1416	1441	1466
1317	1342	1367	1392	1417	1442	1467
1318	1343	1368	1393	1418	1443	1468
1319	1344	1369	1394	1419	1444	1469
1320	1345	1370	1395	1420	1445	1470
1321	1346	1371	1396	1421	1446	1471
1322	1347	1372	1397	1422	1447	1472
1323	1348	1373	1398	1423	1448	1473
1324	1349	1374	1399	1424	1449	1474
1325	1350	1375	1400	1425	1450	1475
1326	1351	1376	1401	1426	1451	1476
1327	1352	1377	1402	1427	1452	1477
1328	1353	1378	1403	1428	1453	1478
1329	1354	1379	1404	1429	1454	1479

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TW5 9RT
England

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POSTAGE
HERE

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BYTE

SOFTLINE®. THE BEST BUYS IN OVER 170 COUNTRIES.

SOFTWARE

• (Items in RED run under Windows)

Word Processors/Editors

Ami Pro 2.0	$307
Brief 3.1	169
Faxgrabber 1.0	101
Grammatik IV 2.0	58
Justwrite 2.0	166
Microsoft Word 2.0 for Windows	319
Microsoft Word 5.5	223
WordPerfect 5.1 for DOS	274
WordPerfect 5.1 for Windows	282
Wordstar 7.0	274

Project Management

Microsoft Project 3.0 f/Windows	461
Superproject 2.0	550
Timeline 1.0	465

Database & Tools

Asksam 5.0	219
B-trieve 5.10 for DOS	414
B-trieve 5.10 for OS/2	405
B-trieve 5.10 for Windows	412
C-tree Plus 1.0	451
Clarion Professional Devel 2.1	468
Clipper 5.01	519
Dataease 4.24	538
Dbase IV 1.5	504
Dbase IV Developer Edition 1.1	899
Dbfast/Windows 1.7C	397
DBXL 1.3R	133
Foxpro 2.0	489
Paradox 2.0 for OS/2	518
Paradox 4.0	514
Q&A 4.0	265
R:base 3.1	483
R:base 3.1 for OS/2 1-3 User	554
Superbase 4 Windows rel 1.3	480

Statistics

SPSS PC+ Adv Statistics 4.0	254
SPSS PC+ Base Package 4.0 (DOS)	168
Statgraphics Plus	981

Desktop Publishing

Adobe Type Manager 2.0	$63
Aldus Persuasion 2.1	335
Aldus Photostyler 1.1A	537
Arts & Letters Graphics Ed 3.12	342
Facelift 1.2	60
Microsoft Publisher 1.0	132
Pagemaker 3.01 for OS/2	532
Pagemaker 4.0	532
Per:form Pro Design+Filler 1.0	182
PFS:First Publisher 3.0	89
Publishers' Type Foundry 1.5	322
Ventura Publisher Gold 4.01	537

Graphics

Adobe Illustrator 1.1	369
Adobe Streamline 1.1	124
Applause II 1.5	353
Charisma 2.1	335
Corel Artshow '91 - CD NA	43
Corel Draw 2.0 for OS/2	384
Corel Draw 3.0	384
Designer 3.1 for OS/2	472
Designer 3.1 for Windows	427
Drafix Cad for Windows 2.0	428
DrawPerfect 1.1	292
Freelance Graphics 1.0 for Windows	360
Freelance Graphics 4.0 for DOS	335
GEM/3 Presentation Team 2.0	337
Harvard Draw 1.0	424
Harvard Graphics 1.0 for Windows	327
Harvard Graphics 3.0	413
Hijaak 1.0	124
Microsoft Powerpoint 3.0	327
Windows Draw 3.0	101

Spreadsheets

Lotus 1-2-3 rel 1.1 for Windows	427
Lotus 1-2-3 rel 2.4	354
Lotus 1-2-3 rel 3.1+	428
Lotus 1-2-3 for OS/2 1.1	513
Microsoft PC Excell 4.0	322
Quattro Pro 4.0	324

Desktop Environments

Desqview 386 2.4	$133
HP New Wave 3.0	108
Microsoft Windows	95
Sidekick 2.0	58

Project Management

Microsoft Project 3.0 f/Windows	461
Superproject 2.0	550
Timeline 1.0	465

Multimedia

Asymetrix Multimedia Toolbk-CD 1.5	$513
MS Multimedia Beethoven - CD 1.1	53
MS Multimedia Bookshelf - CD 1991 Ed	129
MS Multimedia Dev Kit - CD 1.0	320

OCR

Omnipage Pro 2.1	661
Readright 2.01	305
Wordscan Plus 1.1	667

Languages & Programming Tools

ABC Flowchart 1.13	$182
Asymetrix Toolbook 1.5	291
Borland C++ 3.1	338
DR DOS 6.0	67
Interactive Easyflow 7.0	193
MS Basic Comp 7.1 (DOS/OS/2)	328
MS C with C++ 7.0	327
MS Cobol Comp 4.5 (DOS/OS/2)	595
MS Device Driver 3.1 f/Windows	332
MS Pascal Comp 4.0 (DOS/OS/2	199
MS Quick C 1.0 for Windows	132
MS Visual Basic 1.0 f/Windows	132
MS Windows SDK 3.0	330
MS-DOS 5.0 (generic)	48
MS-DOS 5.0 Upgrade	59
Objectvision 2.0	105
Turbo C++ 3.1 for Windows	105
Turbo Debugger & Tools 2.0	105
Turbo Pascal 1.5 for Windows	121
Zortec C++ 3.0 (DOS/WIN/OS/2)	465
Zortec C++ Sci & Eng 3.0 (D/W/O)	664

Integrated Packages

Lotus Symphony 2.2	505
Lotus Works 3.0	92
Microsoft Works 2.0	99
Wingz for PC 1.1A	320
WordPerfect Works 1.0	94

Network/Multiuser

Novell NetWare 2.2 10 User	1,170
Novell NetWare 2.2 50 User	2,343
Novell NetWare 3.11 10 User	1,481
Novell NetWare 3.11 100 User	4,152
Novell NetWare 3.11 20 User	2,049
Novell NetWare Lite	70
PC-MOS 4.1 - 5 User	459

Productivity Tools

Dan Bricklins Demo II 3.0	201
Microsoft Money 1.0	46
Microsoft Office 2.5	496
Microsoft Productivity Pak 3.1	40
On Target 1.0	265
Packrat 4.0 for Windows	243

Communications

Carbon Copy 1.0 for Windows	$133
Close-up Customer/Terminal 3.0	123
Crosstalk 3.0 for Windows	120
Dynacomm Term Emul Asynchronous	141
Microcourier 1.0	67
Procomm Plus 1.0 for Windows	82
Procomm Plus 2.01	70
Relay Gold 5.0	175
Smarterm 240 3.1	207
Winconnect 1.0A	61
Winfax Pro	74

Utilities

386 Max Pro 6.01	61
Back-it 4 1.0	53
Central Point Antivirus 1.3	84
Central Point Backup 7.1	84
Check-It 3.0	83
Fastback Plus 3.0	122
HDC Icon Designer 2.0	33
Laplink Pro 4.0	104
Microsoft Windows Debugger 3.1	130
Norton Antivirus 2.0 (DOS/Win)	85
Norton Backup 2.0 (DOS/Win)	86
Norton Desktop 1.0 for DOS	118
Norton Desktop 2.0 for Windows	99
PCTOOLS 7.1 (DOS/Windows)	112
QDOS III Gazelle 1.0	43
QEMM 386 Exp Mem Mgr 6.01	61
Stacker 2.0	86
Super PC-Kwik 4.1	47
Superstor 2.0	78
Xtree Gold 2.5	97

Workgroup/ Group Productivity

CC:Mail 1.0 Windows Platform Pk	343
CC:Mail 3.2 - 8 User Pack	135
CC:Mail 3.2 MS-DOS Platform Pack	136
MS PC Mail 2.1 - 20 User Lic Pk	889
MS PC Mail 2.1 Remote Wkstn	129
MS PC Mail 2.1 Server	459
WordPerfect Office PC 3.01	89

HARDWARE

Display Boards

ATI Graphics/Ultra w/1MB (PCA)	$488
Diamond Stealth VRAM w/1MB (PCA)	267
Hercules Graphics Stn w/1MB(PCA)	489
Orchid Fahrenheit 1280 w/1MB(PCA)	297
Paradise Accel Crd f/Win w/1MB	217
STB Wind/X Ultra w/1MB (PCA)	296
Video 7 WIN.VGA w/1MB (PCA)	171

Emulation Boards

AST 5251-11 Enhanced Plus (PCA)	505
DCA IRMA 3 Convertible (PCA)	430
Xircom Pocket 3270 Adapter f/Win	551

Facsimile Hardware

Boca Bocafax 9624 Internal (PCA)	79
Complete PC Communicator	309
Complete PC Fax Port (9600)	309
Intel Satisfaxtion Classic (PCA)	338
Megahertz Fax/Modm 96/96 S/R Ext	495

Printers & Accessories

Canon Bubblejet Printer BJ10EX	354
HP Deskjet 500C Color Printer	756
HP Laserjet III	1,627
HP Paintjet Color Printer	756
Pacific 25-In-One (all HP models	273
Pacific 2MB Exp (2P,3P,3,3D)	131
Pacific 4MB Exp (2P,3P,3,3D)	221
PacificPage PS Cart(2P/D,3/3P/D)	298

Network Interface Cards

3COM Etherlink II TP 16 bit (PCA)	$175
3COM Etherlink II TP 16 bit 5 Pk	748
ADIC DCB Dsk Coprocessor Bd Ch1	322
Eagle NE1000 8bit Ethnet (PCA)	131
Eagle NE2000 16bit Ethnet (PCA)	162
Eagle NE3200A 32-bit Ethnet(EISA	698
Eagle Ntwre Lite Add Kit NE2000	215
Eagle Ntwre Lite Strt Kit NE2000	422
Proteon Pronet-4/16 Busmstr (PCA	516
SMC PC600FS Arcnet Serv 16bit CX	205
SMC PC600WS Arcnt Wkstn 16bit CX	127
Tom.Conrad Ethnt 10base-T (PCA)	121
Tom.Conrad Ethnt 10base-T 10 Pk	1,355

Scanners & Input Devices

Logitech 2-Butt Ser Mouse w/Win	71
Logitech Trackman Serial	54
MS Ballpoint Mouse	125
MS Bus Mouse w/Paintbrush	105
MS Bus Mouse w/Win 3.1	156
MS Ser Mouse 5-Pack	383
Summa Summasketch II 12x12 16but	345
Thumbelina Portable	63
Caere Typist+ Graphics OCR Scanr	391
HP Scanjet IIP w/Interface (PCA)	914
Logitech Scanman Mod 256 (PCA)	273
Logitech Scanman Mod 32 (PCA)	137

Please call for items not listed

SOFTLINE MAKES BUYING AS SIMPLE AS . . .

1. Ordering

Fax your order & inquires to us *24 hours a day*

1•718•438•2315

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Call us at

1•718•438•6057

(9:00 to17:00 U.S. EST, Mon.-Fri.)
All prices and payments are in U.S.D., and do not include shipping, insurance, and other fees. VAT and duties will be collected at delivery. Please confirm prices, availability, shipping costs and other fees at time of order. Please specify 3 1/2" or 5 1/4" diskette size.

2. Shipping

Ask for Federal Express, DHL or UPS,

if you want 2 to 4 day service through customs to your door.

or

For large orders, we also ship via economic **Air Freight**, with 1 week delivery. Please confirm shipping costs when placing your order.

3. Payment

For fastest Ordering,

use your **Visa, MasterCard, American Express,** or **EuroCard**. Simply provide us with your credit card number, expiration date, shipping and billing addresses when ordering. A 3% surcharge is added.

Or you can...

Wire Transfer funds directly to our account at Manufacturer's Hanover Trust (ABA# 021000306)
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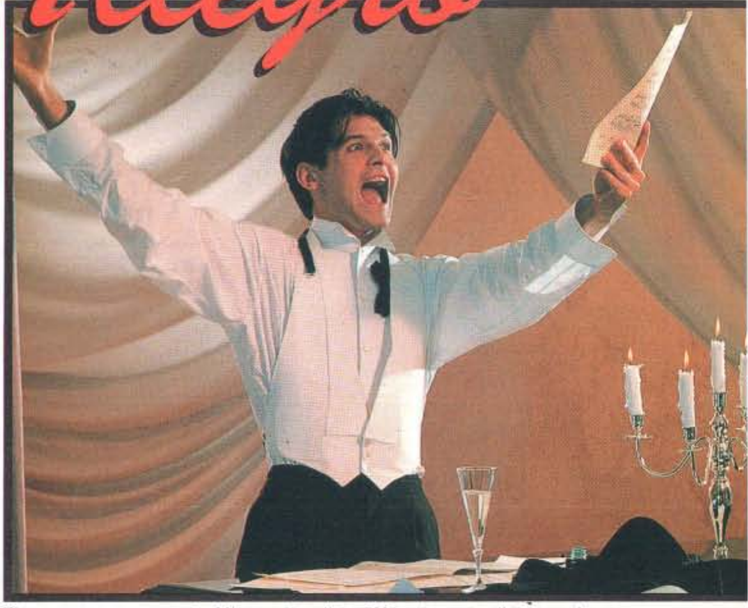

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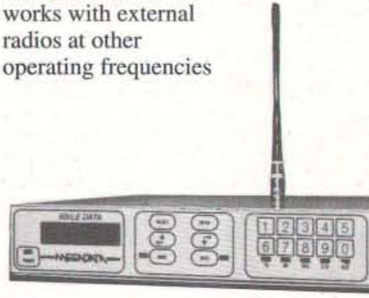

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NETWORK FAX ON TAP

Network fax servers bring computer fax to every desktop

RAYMOND GA CÔTÉ, STEVE APIKI, AND STAN WSZOLA

Fax is the superhero among corporate communications channels—faster than overnight mail, more widespread than any E-mail system, and able to transmit graphics information with a single phone call. But it also has some serious flaws, like poor-quality scanned images, no security for incoming documents, and long lines at the fax machine (not to mention curly fax paper).

Computer-based fax has overcome a lot of these limitations, but there's still one area where the office fax machine enjoys a big advantage over a desktop fax system: Fax machines are shareable resources; desktop fax boards are not. Having one or two users who can send and receive faxes without leaving their desks doesn't replace a fax machine that used to serve the entire workgroup, regardless of the fax machine's frailties.

The solution, of course, is to tie together a LAN and a fax. This month's Solutions Focus looks at network fax servers, which promise to put a computer-based fax system (or at least a shared portion of one) on every desktop.

We'll look at 11 of the top players in the fax-server market for PC, Mac, and Unix networks: Alcom's LanFax Redirector 2.1, Calculus's Advanced EZ-Fax for Networks 3.53, Cheyenne Software's Faxserve 1.0, Intel's Net Satisfaxtion Software 2.0, OAZ Communications' NetFax 4.01, Optus Software's Facsys 3.30a, Pure Data's PureFax 3.1, Circuit Research's 4Sight Fax 2.0.3, STF Technologies' Faxstf Net 2.2.3, The Bristol Group's IsoFax 5.1, and Samsung Software America's Replix 1.0. (One familiar name, GammaLink's GammaNet, is not included—the company has abandoned its software products to focus on its hardware line.) Note that each of these is a computer-based system (i.e., they all require a dedicated or nondedicated host machine). In most cases, these systems are less expensive—if somewhat less extensible—than stand-alone fax servers, such as those from Biscom and Castelle.

Client-Server Faxing

From a network client, you use a fax server much as you would use a stand-alone computer fax board. Client utilities usually include printer drivers or print-capture

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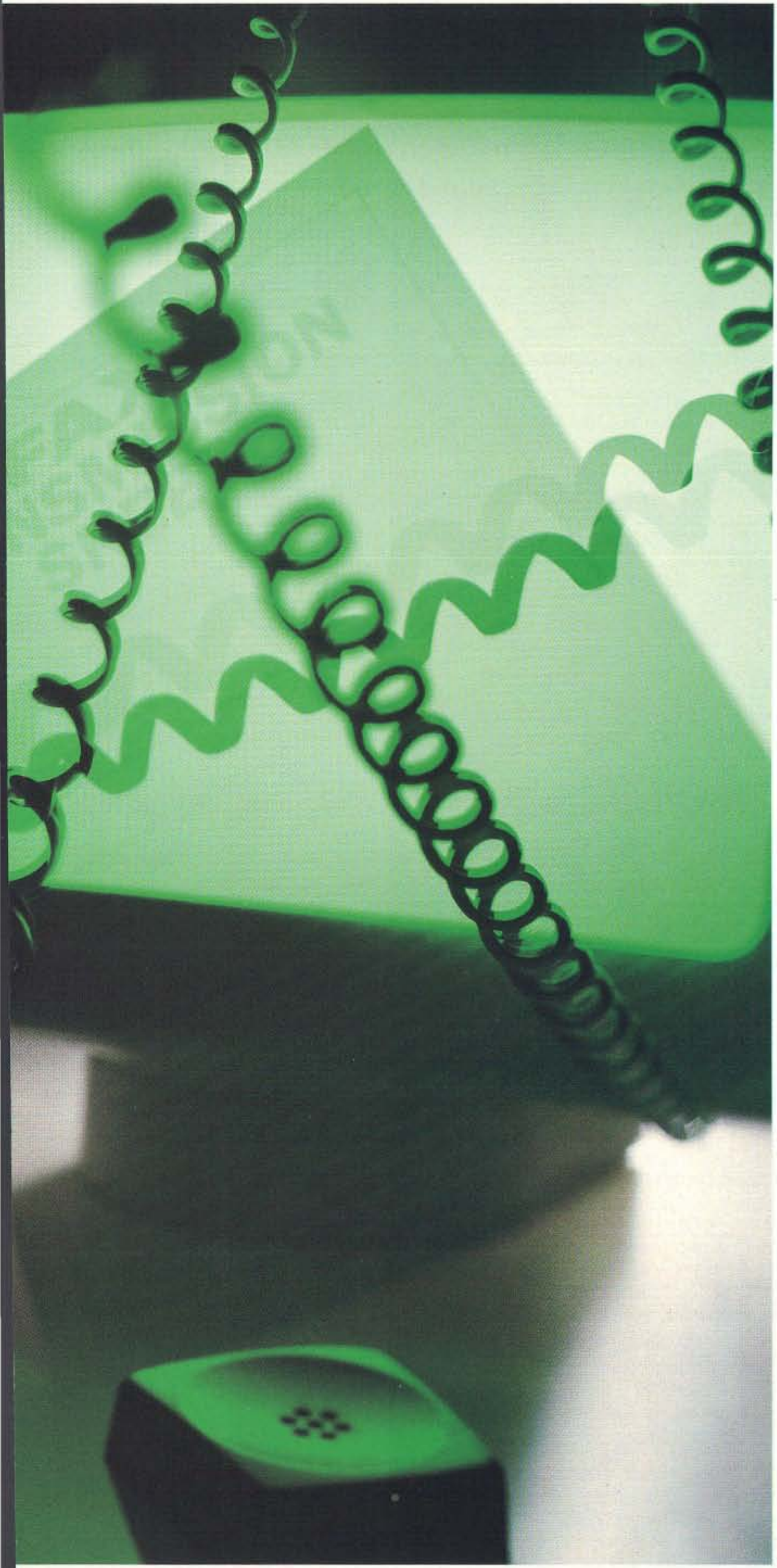


BYTE ACTION SUMMARY

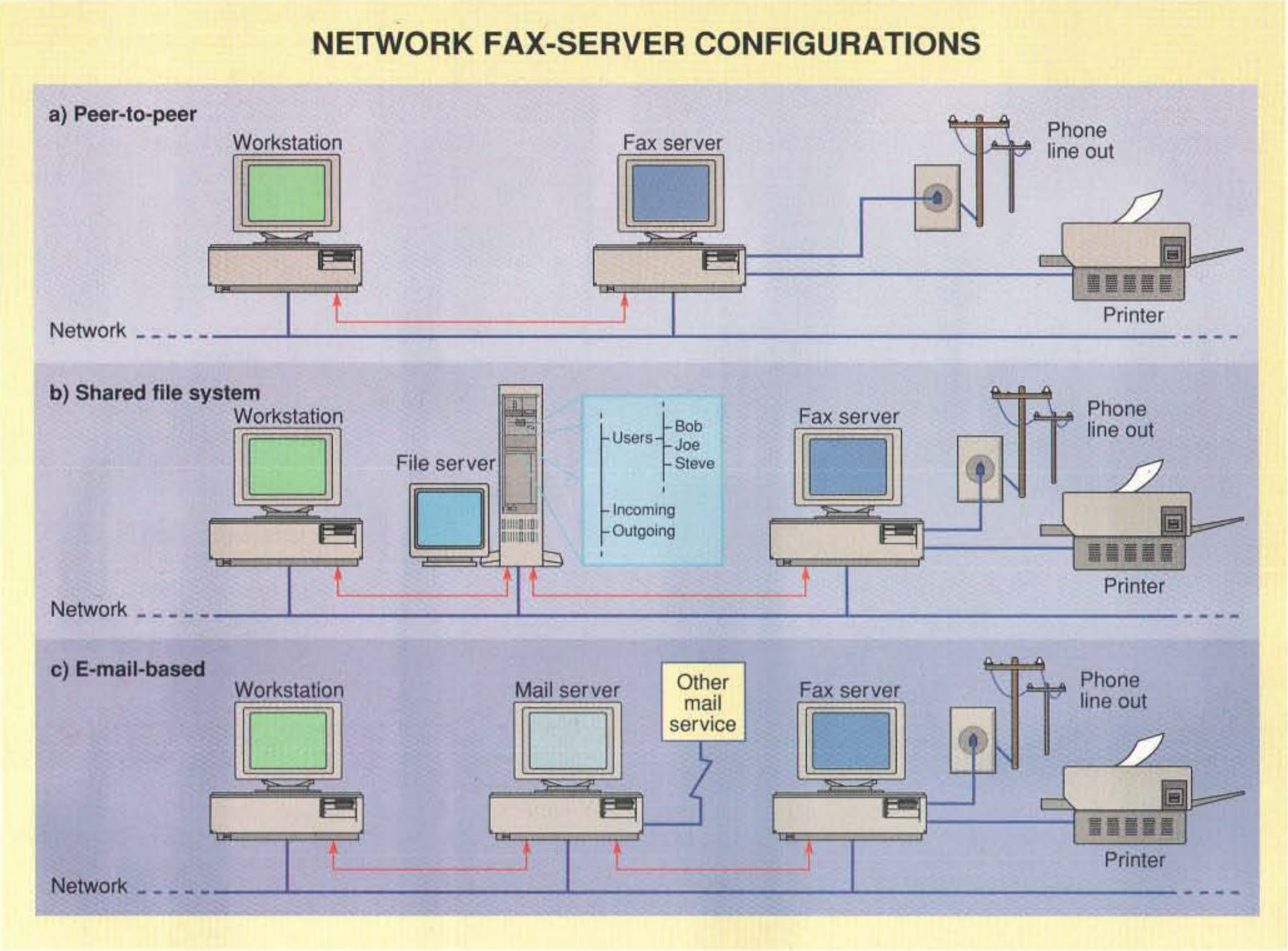
- **WHAT FAX SERVERS ARE**
  Client-server software packages that share computer-based fax services among network users.
- **LIKES**
  Sharing a computer-based fax on a network saves money and countless hours compared to fax machines or a stand-alone computer-based fax; many packages integrate fax with E-mail.
- **DISLIKES**
  Routing incoming faxes to users is a problem that awaits a workable solution. Products are often difficult to install and administer, and no package has multiplatform support.
- **RECOMMENDATIONS**
  4Sight for Mac networks; Replix for Unix installations; and four PC-based packages with various strengths: LanFax Redirector, Net Satisfaxtion, Faxserve, and Facsys.

utilities, which let you fax by printing within an application, and full fax applications, which let you fax files and view and print incoming documents. Many also include command-line utilities for automating fax transactions or monitoring fax status.

Whatever the task, the client software executes it by passing along service requests to the fax server, which operates the hardware. Each communications link—between client application and client fax software, between client fax software and fax-server software, and between fax-server software and fax modem—relies on a fragile web of proprietary and standard protocols. The text box "Standards and Practices" on page 182 details some recent industry efforts to standardize communication between applications software and fax hardware for both network and stand-alone fax applications.

There are as many ways to implement a client-server fax system as there are fax servers on the market, but each package fits more or less into one of three configurations (see the figure). The first configuration is peer to peer. In this arrangement, fax-server and fax-client software communicate directly via network-transport protocols (e.g., Novell's IPX). The benefits of this design are reduced file-server traffic and real-time client-server communication.

In the second configuration, the shared-



Three client-server organizations for network fax servers. **(a)** *Peer-to-peer fax servers communicate with clients directly through network protocols.* **(b)** *A shared-directory design uses polling of a shared-file system on the file server for client-server communication.* **(c)** *E-mail-based fax servers get faxes from users and send received faxes back via standard mail transports.*

file configuration, the fax server and the fax client communicate through reserved directory areas on a file server. For example, a client may write outgoing fax images to a directory called Outgoing on the file server. The fax server polls the directory and sends over the wire whatever files land in the Outgoing directory. The fax server may write incoming faxes to an Incoming directory and, once the faxes are identified, route them to individual user subdirectories. Client modules for each user poll the user directories for incoming faxes. This is a common configuration that makes for simple operation and reduces dependency on specific network operating systems.

The third fax-server configuration is mail-based and relies on E-mail as a transport between clients and server. Clients "mail" faxes for transmission, and the fax server mails incoming faxes to the appropriate user. This scheme works best if the system in your office already relies on E-mail, providing a transparent link between these two methods of communication.

The Ins and Outs of Network Fax

Despite their differences, all 11 packages reviewed here provide LAN clients with three basic capabilities: image conversion, fax transmission, and fax reception. All consist of at least server and client software modules, and all require fax-modem hardware. In some cases, the fax modem is provided with the package (see the table for configuration details), but most require a fax modem in addition to the server software.

Transmitting an electronic fax requires at least two steps. First, the document must be converted into an electronic fax format. Second, it must be transmitted to the destination fax. Some systems perform both of these steps on the server, while others rely on the client for image conversions. In some cases (most notably the Windows printer drivers), imaging is actually a two-step process; documents are converted to one format on the client and then reconverted to a fax format on the server.

All the PC-based packages take advantage of coprocessor-based fax-modem boards such as Intel's Net Satisfaxtion and GammaLink's GammaFax CP to reduce imaging time. These boards convert from ASCII text or bit-map image formats to a Group 3 byte stream without requiring work from the host processor. The Mac and Unix servers use external modems, and the host computer is responsible for all imaging.

Network fax servers' greatest weakness is in routing received faxes. Unfortunately, there is no standard method for specifying the addressee of a fax document through a shared fax system (although the CCITT is working on extending fax

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Standards and Practices

For software developers, the marriage of fax, computer, and LAN has been a difficult one. Unlike data communications, where there are standard methods for writing to hardware, there is no common starting point for working with fax modems.

In 1988, the CCITT TR29.2 standards committee accepted the Class 1 standard for communication between fax software and fax modems. The committee also voted on, but did not accept for technical reasons, the Class 2 standard. Software developers and fax-modem manufacturers decided to unofficially adopt Class 2 until the CCITT could develop an acceptable standard. In an effort to help define a standard, the EIA (Electronics Industry Association) has produced EIA TR.29, which encompasses Class 1, 2, and 3 command sets to standardize the use of fax modems and applications software.

Class 1, the only standard that has been officially issued, defines six commands that a computer can use to send a fax; for example, transmit or receive at 300 bps for parameter negotiations, and transmit or receive at 9600 bps for fax transmission. Class 1 fax software handles all the T.4 fax-image and T.30 session-protocol information and timing.

The Class 1 commands require the minimum amount of hardware to manipulate and send a fax. This means that a Class 1 fax modem requires more CPU and system resources. Sending or receiving a fax with Class 1 fax modems and software typically means that active fax-conversion tasks can't run in the background.

Class 2 fax software generates a T.4 fax-page image and sends it to the fax modem a page at a time. The fax modem then handles the T.30 session-protocol information and timing. The de facto Class 2 commands provide 40 or more extended AT commands and responses to free up PC or server resources. If the Class 3 standard is ever issued, it will allow ASCII-to-fax or other file-to-fax conversion by modems.

PC APIs

For PCs, there are three defined methods for communicating with fax hardware: Intel/DCA's CAS (Communications Applications Specification), the FaxBIOS Association's FaxBIOS, and the CCITT's T.611 standard. All three are in contention for the title of standard API.

DCA and Intel released CAS in September 1988. CAS defined a standard communications API for working with Intel's Connection CoProcessor board and its successors, the Net Satisfaxtion series.

CAS is a high-level software interface for sending and receiving individual fax files and other binary files. The basic unit of transfer in the CAS interface is an entire file. The CAS Resident Manager routines handle all the details of dialing, connection, file transmission, and call termination. Applications communicate with the Resident Manager, which handles everything in the background. The application and the Resident Manager communicate via control files, which record vital information about transmissions (e.g., phone numbers and transmit time). Unfortunately, CAS is not a network API and extending CAS across the network requires redirectors like those reviewed here.

FaxBIOS is an incompatible superset of the services provided by CAS. FaxBIOS is a high-level API designed for platform independence. It has all the capabilities of CAS, as well as networkwide enhancements. In addition, it has features for telephone directory management, graphics services, and low-level I/O-device control. Fax-BIOS also incorporates a DDE interface for Windows.

Intel has not mentioned support for FaxBIOS, but it has announced support for a new API standard called T.Applecon, or T.611. The T.611 standard was developed by France's telephone company and has been submitted for CCITT approval. Since T.611 was designed to be downward-compatible with CAS, existing CAS-based applications will work on T.611 modems without modification.

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addresses to include routing information). Most fax servers require an administrator to view incoming faxes and route them to users based on visual inspection. EZ-Fax and Faxstf do away with routing altogether by giving users access to all received documents.

However, several methods are available for automatic distribution. DID (Direct Inward Dial), which requires a service provided by the local telephone company, reserves a block of phone numbers for a single phone line. Through DID decoding hardware, the fax server knows which number was dialed and routes the fax to the designated recipient. LanFax Redirector, NetFax, Facsys, 4Sight, and IsoFax all support DID when used with fax modems that provide DID decoding.

A somewhat less complex method of electronic routing uses DTMF signals sent after dialing to route a fax. However, there are no standard DTMF codes, and working effectively with DTMF requires that fax senders know to use the DTMF codes. Again, DTMF requires decoding hardware, which Net Satisfaxtion, Facsys, and 4Sight support.

Finally, Facsys offers an OCR routing capability. Facsys can scan the first page of a document, looking for a sequence of digits as a routing code. This capability suffers from the same drawbacks as DTMF, in that there is no standard method for including numeric codes on a page. Further, it requires OCR to work reliably on sometimes poorly scanned documents from fax machines.

Given the current state of routing technology and standards, simply printing out incoming faxes is probably still your best bet. Except for Faxstf, all these packages offer the option of routing a copy of incoming faxes directly to a printer. For most packages, printing and routing via an administrator are the only methods we tried.

The Proving Ground

We tested each of these fax servers on a test network in the BYTE Lab. For the PC systems, we tested on a Novell NetWare

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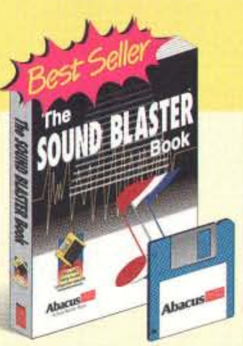

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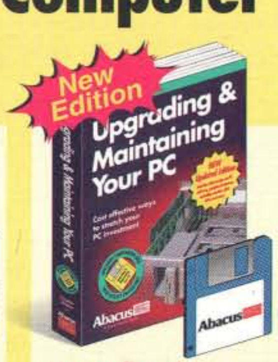

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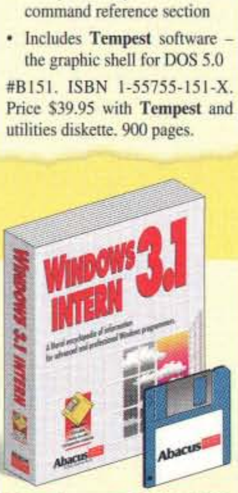

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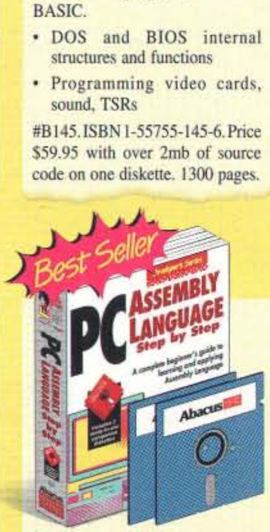

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FAX-SERVER FEATURES

Many of the fax-server packages support a variety of third-party fax modems in addition to the hardware listed here. (● = yes; ○ = no; N/A = not applicable.)

	PC				
	Alcom LanFax Redirector 2.1	**Calculus Advanced EZ-Fax for Networks 3.53**	**Cheyenne Faxserve 1.0**	**Intel Net Satisfaxtion Software 2.0**	**OAZ NetFax 4.01**
Price					
10-user system	$995	$1399[1]	$995	$1995	$2490
50-user system	$2995	$1799	$995	$1995	$2490
Unlimited	$9995[3]	$1799	$995	$1995	$2490
Hardware included	○	●	○	○	●
Server platform	DOS	DOS	NetWare	DOS	DOS
Client platforms	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows
Network support	NetWare, NetBIOS LANs	Any PC-based network	NetWare 3.10 and higher	NetWare	NetWare
Modem support	Class 2, CAS	Proprietary card	Class 2, CAS	CAS	Proprietary board
SENDING FAXES					
Input file formats	ASCII, PCX, DCX, PCL	ASCII, PCX, CUT, PCL, Group 3	PCX, DCX, BMP, PCL	ASCII, PCX, DCX	ASCII, PCL, TIFF, BMP, Group 3, OAZ fax
Print capture	●	●	●	●	●
Font support					
TrueType	●	●	●	●	●
PostScript	●	○	●	○	○
Windows	●	●	●	●	●
Macintosh	○	○	○	○	○
X Window System	○	○	○	○	○
Other	PCL	PCL	PCL	PCL, Epson FX	PCL
Phone books					
System phone books	●	○	○	○	●
User phone books	Within system phone book	●	●	●	●
Priority levels	2	2	○	○	○
Delay sending	●	●	●	●	●
Broadcast fax	●	●	●	●	●
Group faxes to one target	●	●	○	○	○
Fax imaged on client	●	●	●	●	●
Fax imaged on server	●	●	○	○	○
Auto-print outgoing faxes	●	○	○	○	○
Retransmit only unsent portion on retry	○	●	○	●	○
RECEIVING FAXES					
Routing					
Administrator	●	○	●	●	●
OCR	○	○	○	○	○
DID	●	○	○	○	●
DTMF	○	○	○	●	●
Auto-print incoming faxes	●	●	●	●	●
E-mail connections					
Unix mail	○	○	○	○	○
MHS	Option	○	●	○	●
cc:Mail	○	○	○	○	○
QuickMail	○	○	○	○	○
Microsoft Mail	○	○	○	○	○
Date/time stamp	●	●	●	●	●
Invert, size, scale received faxes	●	Windows client only	●	Invert only	Windows client only
Save as format	PCX, DCX, PCL	PCX, CUT	Fax only	Fax only	Fax only
OCR	○	○	○	○	○
ADMINISTRATION					
Administration platform	DOS, Windows	DOS, Windows	DOS, Windows	DOS, Windows	DOS
Transmission log	●	●	●	○	○
Receipt log	●	●	●	○	●
Export transaction log	●	○	●	●	○
Fax diagnostics	●	●	○	○	○
Privilege levels	User, router, admin.	None	User, admin.	User, admin., supervisor	User, admin., supervisor

Notes: [1] Eight user [2] Floating license [3] 250-user maximum [4] Requires DID

FAX-SERVER FEATURES

PC		MAC		UNIX	
Optus Facsys 3.30a	**Pure Data PureFax 3.1**	**Circuit Research 4Sight Fax 2.0.3**	**STF Technologies Faxstf Net 2.23**	**The Bristol Group IsoFax 5.1**	**Samsung Software Replix 1.0**
$995	$699	$999	$249	$1990	$3293[2]
$995	$699	$2749	$249	$3490	$6713
$995	$699	$4999	$249	N/A	N/A
○	●	○	○	○	○
DOS	Windows	Macintosh	Macintosh	Solaris, AIX, HP-UX	HP 700, SCO Unix, Sun Sparcstation, IBM AIX
DOS, Windows	Windows	Macintosh	Macintosh	Unix clients	Unix clients
NetWare	Any PC-based network	○	○	○	○
Intel Satisfaxtion, others	Proprietary board	Class 1, Class 2, Apple Modem, FlexFax Modem	Class 1, Class 2, Apple Modem, Sierra SendFax	Class 2	Class 2
ASCII, PCX, DCX, PCL, PostScript	ASCII, TIFF, DCX, PCX, BMP, IMG	TIFF, EPSF PICT, Paint	TIFF, EPSF, PICT	30 formats	ASCII, PostScript, TIFF, XBM, PBM, MIF
●	●	●	●	●	●
○	●	●	●	○	○
●	○	○	●	●	●
●	●	○	○	○	○
○	○	●	●	○	○
○	○	○	○	●	○
PCL	PCL	○	○	○	○
○	○	●	●	●	●
●	●	●	●	●	●
255	○	2	○	2	○
●	●	●	●	●	●
●	●	●	●	●	●
○	○	●	●	○	○
○	●	○	○	●	●
●	●	●	●	○	○
●	○	●	○	○	●
○	○	●	●	●	○
●	●	●	●	●	●
●	○	○	○	○	○
●	○	Option	○	●	○
●	○	●	○	○	○
●	●	●	○	●	●
○	○	○	○	●	●
●	○	○	○	○	○
○	●	○	○	○	○
○	○	●	○	○	○
○	○	●	○	○	○
●	●	●	●	●	●
Windows client only	●	●	●	●	●
BMP, PCX	IMG, TIFF, MSP, BMP, PCX	PICT, TIFF, Paint	PICT, TIFF, Paint	30 formats	TIFF, PostScript, PBM, XBM
○	○	Option	○	●	○
DOS, Windows	Windows	Macintosh	Macintosh	X Window System, command-line	X Window System, command-line
●	●	●	●	○	●
●	●	●[4]	○	○	●
●	●	●	●	○	●
●	●	○	●	○	●
User, admin., router	User, admin., supervisor	User, admin.	User, admin.	User, admin.	User, admin.

3.11 network running over NE-2000 network cards on a Compaq Deskpro 66M server. Our standard fax server was a CompuAdd 433 system running DOS 5.0 and Windows 3.1 where appropriate. The Macintosh clients and servers ran on a Mac IIfx and a Quadra 950 running System 7.0.1. All Unix testing was performed on a Sun Sparcstation 2 running SunOS 4.1.2 and Open Windows 3.

We used a wide range of fax modems. Many of the PC packages came with their own hardware; otherwise, we defaulted to an Intel Satisfaxtion/200 board. We used external modems from Circuit Research and Dove Computer to test Mac fax servers and an Everex EverFax 24/96E (packages that claim Class 2 support all work with the EverFax modem).

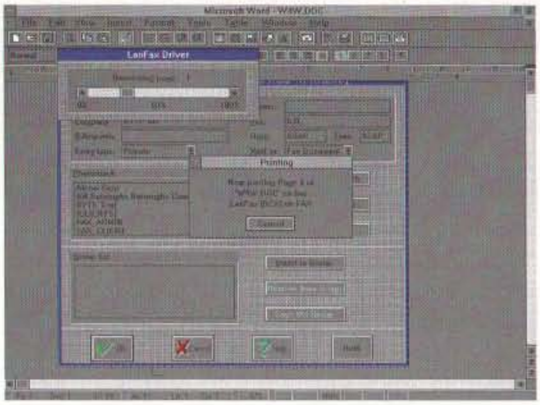
To test each server, we transmitted and received a variety of documents. Transmission test documents included a cover page with a bit-mapped BYTE logo, To/From fields, and a one-line message; a 4-KB text file; a full-page bit-mapped TIFF or PCX file; and, from the Windows PC and the Mac, a complex multicolumn Word document containing several fonts and images. For each, we noted the time it took and any difficulties in the transmission. For most packages, each transmission was instantaneous from a client perspective.

Besides the quantitative testing, we found that qualitative issues play a big part in determining the quality of fax servers. High-visibility items such as the flexibility of administration and routing tools, the client user interface, and the ease with which faxes could be automated are obviously important, but so are little items like cover-page customization, mixing graphics and text, and sharing user telephone-book databases.

Surprisingly, output fax quality is one area where we found little difference from one package to another. Even though you might expect text images created with TrueType or PostScript fonts to generate cleaner images, there isn't much noticeable difference with normal point sizes on a 200-dot-per-inch high-resolution fax. Graphics, too, showed little difference from fax server to fax server.

Unfortunately, none of these fax servers support clients on foreign operating systems, so you'll need to choose one that fits your current network platform. We've broken these products into groups based on operating systems in the following evaluations. Note that the mail-based packages (OAZ's NetFax and Circuit Research's 4Sight) and those that offer gateways to E-mail systems can offer some measure of fax interoperability between platforms.

Fax Servers for PCs



Software-only LanFax Redirector works with CAS hardware and third-party CAS applications. Client access runs through DOS or Windows utilities or through printer drivers, as shown.

LanFax Redirector 2.1

Alcom's LanFax Redirector does just what its name implies—it redirects CAS (Communications-Applications-Specification)-service requests from fax-client software to a dedicated fax server, using IPX/SPX or NetBIOS as a transport. Its clean architecture, combined with remarkably flexible DOS and Windows client software, makes LanFax Redirector one of the top picks in this review.

We tested LanFax Redirector with an Intel Satisfaxtion Modem/200, but the software supports any CAS-compatible board, and it can handle up to eight modems in a single server. The CAS-centric approach brings with it some nice features, such as automatic handling of ASCII documents and the ability to send binary data to another CAS modem.

Installing LanFax Redirector is relatively painless. You install the board and run a utility that installs the server software and builds the system databases. Once it's up and running, the server collects CAS requests from clients and processes them through a CAS modem. It also maintains transaction records by user in a central system database administered through Borland's Paradox engine.

LanFax Redirector maintains its own list of authorized users, distinct from the network user list. But, you aren't forced to add users manually. You can configure server software to accept fax requests from any user and automatically add these users to the database. After this initial process, you can switch off the automatic-acceptance feature and manually tweak user rights.

Users may be administrators, users, or routers. Users deal only with their personal queues; routers can view the first page of any inbound fax and forward it to the appropriate queue. Unfortunately, routers can easily circumvent the first-page feature simply by routing the fax to their personal queue and forwarding it later. If security is a critical issue, you can monitor the audit trail that LanFax Redirector maintains.

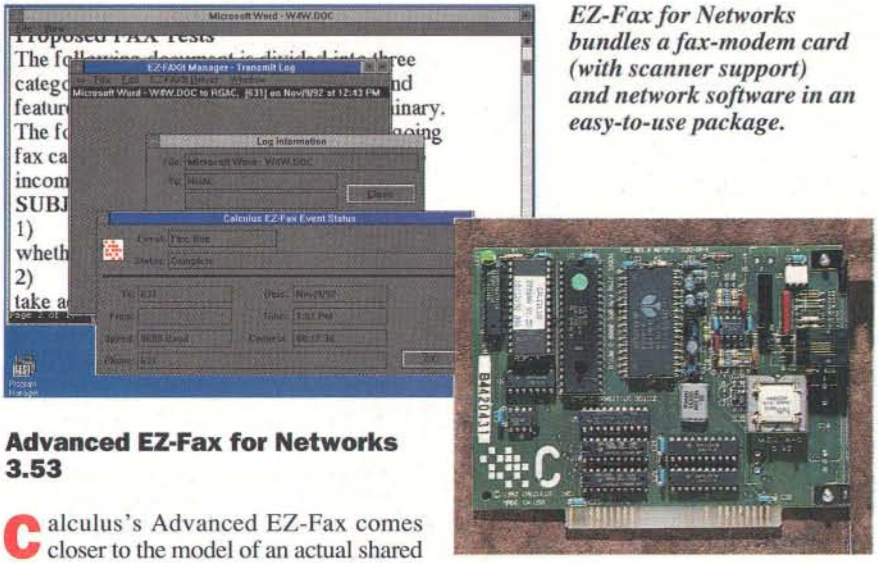
Users share a central phone book (again, a Paradox-compatible database). Entries are simply flagged as public, private, or shared. In contrast to those of the other packages, which require users to switch constantly between system and personal phone books, LanFax Redirector's phonebook structure is a real boon.

Users also share access to libraries—collections of preimaged faxes that are sent repeatedly (e.g., price lists); skipping the imaging process makes these fax quickly. However, LanFax Redirector's PCL (printer control language)-imaging engine is fast enough that you'll hardly notice the difference anyway.

Alcom's software bundle includes DOS and Windows clients. Both require a redirection TSR program. The DOS utilities include a print-capture TSR and the menu-driven Fax Manager. Fax Manager can be used to transmit PCX, ASCII, and fax files; view user status; and receive documents.

Windows utilities include a fax printer driver and a nice, Borland-style menuing system for managing fax documents. If you're a Windows user, you can easily select cover-page logos and attachment files. However, as with all CAS-based packages, you aren't free to rearrange the position of address and logo information on the cover page. The Windows printer driver includes a handy Hold feature that lets you tack documents from multiple applications into a single fax. If you need to fax a spreadsheet and a letter, you just choose Hold after printing from Excel, print to the same driver from WordPerfect for Windows, and then release the fax.

If you require E-mail integration, you can get it through an optional MHS (Message Handling Service) gateway ($3595), which we didn't test. The bundle we did test lists at $2995 (without hardware) for a 50-user system.


Microsoft Word - W4W.DOC
Proposed FAX Tests
EZ-FAXit Manager - Transmit Log
Microsoft Word - W4W.DOC to RGAC, [631] on Nov/9/92 at 12:43 PM
Log Information
Close
Calculus EZ-Fax Event Status
Status: Complete
OK
Program Manager

EZ-Fax for Networks bundles a fax-modem card (with scanner support) and network software in an easy-to-use package.

Advanced EZ-Fax for Networks 3.53

Calculus's Advanced EZ-Fax comes closer to the model of an actual shared fax machine than do any of the other servers. Like real fax machines, it includes built-in scanner support for sending paper documents and doesn't require a dedicated PC to service fax requests. But on the downside, EZ-Fax also lacks security features, easily configured cover pages, and E-mail integration. EZ-Fax includes a fax-modem/scanner card and server software, as well as Windows and DOS client utilities, for $1799 for a 10- or 50-user system.

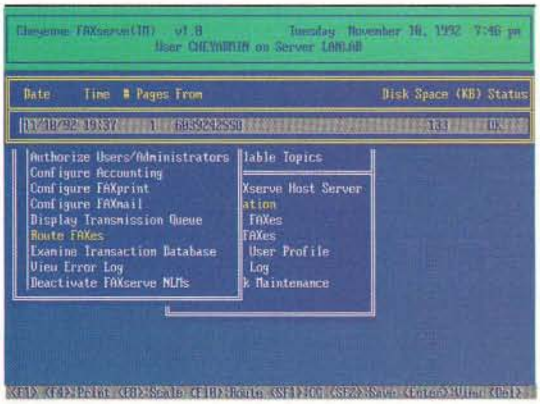
EZ-Fax relies on a simple shared-directory structure. It works with any PC-based network that lets you export directories, including peer LANs. Because there are no security features, there are no user IDs to maintain, no privilege levels, and no routing. Every user has access to every inbound fax, and every user with access to client software and the shared directory can transmit faxes.

The EZ-Fax server is a nondedicated machine that runs a background process that requires 166 KB of conventional memory (considerably less with EMS). One user can continue to use the EZ-Fax server for other tasks, but the background process will occasionally take over the machine for file conversion. In practice, we found that the fax-server machine probably shouldn't be used for much more than light word processing.

Client software has print-redirection utilities and menu-driven DOS and Windows programs. When you launch a print job with an EZ-Fax print-capture utility installed, you can choose between faxing and printing; thus, you can leave the redirectors installed at all times and don't have to bother installing or uninstalling them.

With the Calculus Windows Fax Manager, you can view both transmit and receive logs or maintain phone books (each user can have multiple phone books). However, you can't simply fax a file from within the Windows fax manager. Calculus licenses the manager from Alien Computing, so if you know Faxit, you'll find it familiar going.

EZ-Fax makes heavy use of tags in text files for embedding graphics. You can define cover sheets with this method or attach preimaged files to local faxes.



```
Cheyenne FAXserve(TM)  v1.0            Tuesday  November 10, 1992  7:46 pm
                  User CHEYADMIN on Server LANLAB

Date     Time  # Pages From                          Disk Space (KB) Status
11/10/92 19:37     1  6059242550                               133      OK
```

As expected, NLM-based Faxserve's NetWare integration is very good. Client tools, shown here, provide a familiar NetWare-like C-Worthy interface to the fax server.

Faxserve 1.0

One significant cost in building a network fax solution is the price of dedicating a high-powered workstation to the task of sending and receiving faxes. If you run a NetWare LAN, Cheyenne's NLM (NetWare loadable module)-based Faxserve provides an attractive alternative.

Faxserve is the first (and so far the only) network fax server built as a collection of NetWare NLMs. With Faxserve, you install the fax-modem card in the file server, eliminating the need for extra hardware. Obviously, this exacts an additional processing toll on your file server; however, we didn't find that it added much of a strain on our test network. Since file servers are so often limited by I/O requirements rather than by CPU horsepower, we expect our experience will be typical among Faxserve users.

Faxserve works with CAS applications using shared directories. Faxserve can also route faxes through MHS with FAXMAIL .NLM, a second module bundled with the package. Faxserve sells for $995, including mail support and DOS and Windows clients. We ran Faxserve with an Intel Satisfaxtion Modem/200.

You install Faxserve from a client workstation and then load the NLMs on the file server. Installation is easy and includes copying DOS and Windows client software to the network. Installing Faxserve generates a new NetWare user, named faxserve, on the server you select, which the Faxserve NLM uses for access to print queues and other NetWare services.

Naturally, Faxserve's integration with NetWare is tight. When you bring up Faxserve for the first time, you can pull users out of the NetWare bindery into Faxserve's user list, configuring users as either administrators or users. It's worth stressing that Faxserve's user list is distinct from NetWare's, and you are required to maintain user lists for both entities.

By default, Faxserve uses NetWare's Mail directory structure for storing custom user files. This includes (CAS format) user phone books and custom cover-sheet logos. Faxserve DOS clients can switch between phone books, so we arranged for Faxserve clients to have access to both a central phone book and custom user versions. Windows clients maintain their own phone books in non-CAS format. The method for switching Windows phone books is clumsy—users need to change phone books in a configuration menu that's unrelated to sending and receiving.

continued

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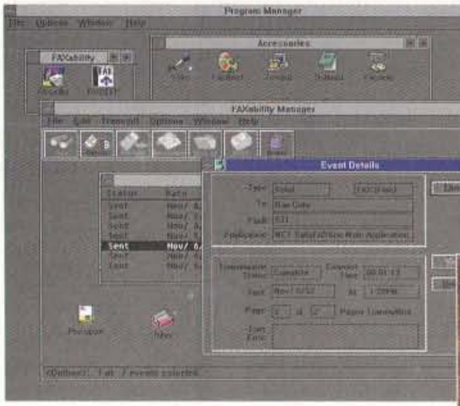
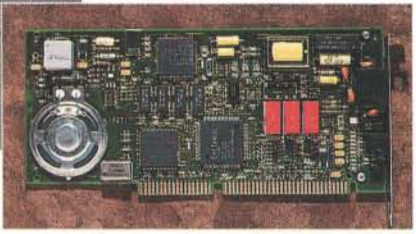
Incoming faxes arrive in a central location. Users with administrator access privileges must view and route faxes manually, although you can set up Faxserve to automatically print incoming faxes to a printer on the file server or on any NetWare queue. Once the administrator has routed a fax, it lands in the addressee's mail directory.

You can send a fax through print-capture drivers or menu-driven utilities from DOS or Windows, and the utilities are easy enough to work with. But, you can't fax files directly from DOS clients; you must work through print capture. DOS client software and the installation and management utilities use a C-Worthy interface that will be familiar to any NetWare user. Cheyenne's Windows FaxClient manager is licensed from Alien Computing and bears a striking resemblance to the one provided by Calculus with EZ-Fax.



Faxability, Intel's Windows client, provides a nice MDI that's easy to get around in. We tested Net Satisfaxtion with Intel's Satisfaxtion Modem/200 in the server.



Net Satisfaxtion Software 2.0 and Satisfaxtion Modem/200

Intel's Net Satisfaxtion is similar in architecture to Alcom's LanFax Redirector. Net Satisfaxtion is a CAS redirector that funnels client CAS service requests to a dedicated CAS-based server. However, Net Satisfaxtion supports only IPX/SPX as a transport, so it's limited to NetWare LANs. Net Satisfaxtion supports, but does not include, any Satisfaxtion modem; the software sells for $1995, including clients. The Satisfaxtion Modem/200 costs $369.

Net Satisfaxtion relies on NetWare for its transport, so it can afford some reliance on NetWare user information. Like most other packages, Net Satisfaxtion maintains its own user list, but you can pull users directly out of the NetWare bindery into Net Satisfaxtion. However, you will need to manually set some user access rights and set up the system log-in script to personalize each user's installation. In Net Satisfaxtion, users can have normal privileges or be designated as administrators or supervisors. As with LanFax Redirector, administrators can view first pages and route faxes. Supervisors can configure accounts.

Net Satisfaxtion includes DOS and Windows client software. Both clients require that users run a CAS redirection TSR. DOS clients can then choose between a print-capture TSR, a menu-based send/receive and status-inquiry program, and administrative utilities. Using the DOS TSRs is straightforward.

Both Windows and DOS clients of Net Satisfaxtion use CAS-format phone books, and users can easily switch among them. Again, we found the best way to work with this architecture was to create a shared company phone book and individual phone books for each user. Users can also tailor cover sheets and easily choose the cover-page logo.

One of the nicest features of Net Satisfaxtion is that it includes Intel's Faxability for Windows as its Windows client module. Faxability features the best user interface among Windows clients we have seen. It is simple to navigate and has toolbar icons that are refreshingly obvious. Faxability has MDI (Multiple Document Interface) windows (with cute icons) for the inbound fax log, outbound fax log, and user telephone book. In addition, faxability is the easiest and most usable package when it comes to customizing the cover page. Between these features and the toolbar, Faxability beats the other Windows fax clients hands-down. Faxability also includes a CAS-based printer driver for printing from within applications.

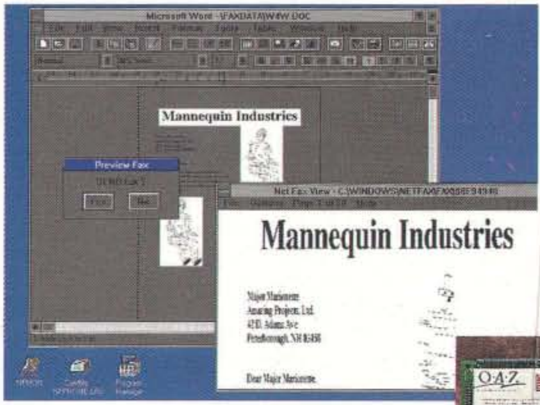
NetFax 4.01

E-mail, an option for many of these packages, provides the foundation for OAZ Communications' NetFax. NetFax uses Novell's MHS as a transport between fax-client stations and a dedicated server, which forms a gateway between MHS mail and fax. NetFax includes server software, a proprietary fax-modem board, and DOS and Windows clients for $2490. A NetWare network running MHS is required.

NetFax works by creating an MHS user ID for the fax server. Once this is in place, users mail fax messages to the fax server, and the fax server mails received faxes back to users.

Once we got NetFax installed, we found it robust and relatively easy to use from a client perspective. However, installing the package was a nightmare. Even though it comes with an automatic installation script, changing a default parameter (i.e., the MHS user name for the server) caused the script to update the name in some parts of the program but not in others, and it wouldn't work properly. We went through the installation process several times.

Authorized NetFax users are a subset of the users with MHS addresses. At installation time, you can pull NetFax user information out of the NetWare bindery, and the utility also builds the MHS directory structure from user names in the bindery. There are no separate NetFax privilege levels, and this sidesteps most management issues. However, if you want fax security, you'll need to assign NetWare permissions manually to the incoming message directory.



OAZ's client component puts a Windows face on NetFax, an E-mail-oriented fax server that runs on Novell's MHS. NetFax also includes a proprietary fax modem.

If you have an MHS-compatible mail system, you can use it to mail fax messages to the mail server. Faxes are always sent as cover letters, with additional sheets and documents sent as attachments. You specify phone numbers and other fax-specific information as part of the address line, or you can embed this information with command tags. Mail users receive faxes through MHS and can use NetFax client software to view and print faxes. If you aren't running an MHS-compatible mail system, NetFax includes a basic mail package as part of its DOS client software.

The DOS client software also includes a print-capture utility. If you use a third-party mail system as a transport, however, you can't fax directly from within applications; you'll need to capture printer output to a file before using the mail system to mail it (unless the mail system itself supports print capture). DOS users share a systemwide phone book (to which each user can add private entries) and a systemwide logo file.

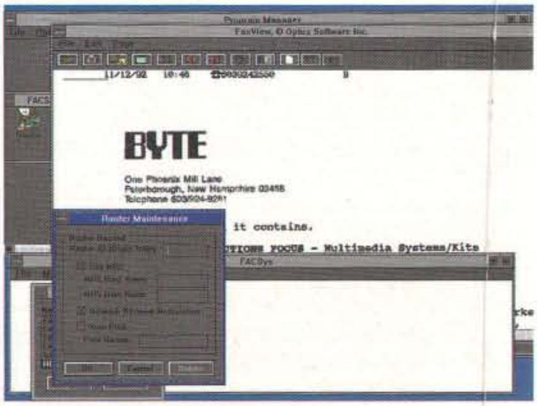
The OAZ Windows client component also works through MHS, and it includes print capture and a stand-alone utility. Both of these hook into the mail-monitoring program via DDE; the monitoring program alerts you to fax events with a blinking icon. Windows phone-book information is kept in a local card file, which provides a nice interface, but this design isolates the Windows phone book from the system phone book provided by the NetFax server.

For inbound faxes, NetFax supports DTMF routing in the standard package. If you don't use DTMF, an administrative user can route faxes via mail from a central directory.

Facsys 3.30a

Unlike many of these packages, which come with enough disks and documentation to make a C compiler feel at home, software-only Facsys from Optus Software comes on a single disk accompanied by a pocket-size manual. The documentation is spotty in places, but Facsys itself is among the most robust, full-featured fax servers in this review.

Facsys consists of a dedicated server that communicates via NetWare protocols, shared directories, and NetWare print queues with fax-client nodes on the network. Facsys is not CAS-specific; in addition to Intel's Satisfaxtion board, Facsys supports the GammaFax board and a few others. However, Optus provides redirection shells (which we didn't test) for supporting CAS and FaxBIOS client applications. Facsys also includes MHS-gateway services for working with E-mail packages. The bundle costs $995.



Facsys includes several unique features, including an OCR routing capability that lets you route incoming faxes based on a numeric ID on the cover page.

Installing Facsys was simple. The installation program creates a NetWare print queue and sets the fax server as the NetWare print server. In effect, the Facsys print queue (PRINTQ_FAX) acts as a direct "fax queue." In addition, the installer creates NetWare groups FAX_ADMIN and FAX_ROUTER, which correspond to Facsys privilege levels. As the NetWare administrator, you simply need to configure a print job for the print queue.

Facsys provides the best NetWare integration of any of these packages. NetWare users are Facsys users; there is no separate name space to keep track of. By default, the NetWare group EVERYONE has access to Facsys services. To set Facsys privilege levels, you add users to the

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Authorized Quantum Distributors:

Austria: Actebis Computerhandels - 43-1-2788282 · Computer 2000 - 43-1-465611
Belgium: Sydec Belgium - 32-3-45 83050 · Tritech Belgium - 32-2- 466 75 35
Croatia: Axis - 38-41-232689
Cypress: Logimetrics - 357-2-366640
Czechoslovakia: Neelem Technologies - 42-2-3115968
Denmark: Datateam - 45-42-818077 · VT Data - 45- 42-44532600
Finland: Gadelius - 358-0-1482177 · TT-Microtrading - 358-0-5027401
France: HIT Technologies - 33-1- 47 90 99 66 · Inelco Périphériques - 33-1- 47 94 81 79 · Ingram Micro - 33-1-20 88 580 0
Germany: Addit Datensysteme - 49-40-669620-0 · Computer 2000 - 49-89-786070 · Neumüller - 49-89-612080 · Peacock Computer - 49-2957-790 · Rein Elektronik - 49-2153-7330
Greece: Info-Quest - 30-1-9248858
Hungary: Axis - 36-1-1417637
Iceland: Taeknival - 354-1-681665
Israel: E.I.M. - 972-3-923 3257 · Wietec - 972-52-583395
Italy: A.E.S.S.E. - 39-2-55181162 · Computer 2000 - 39-2-72228 1
Morocco: Dataco - 212-2-400079
Netherlands: Inelco Electronics 31-70-3821414 · Tritech Corporation- 31-10-4567988
Norway: Gandalf Data - 47-2-950760 · Santech - 47-34-70610
Poland: ABC Data - 48-22-241143
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Sweden: Ambitron - 46-8-893890 · Expander Informatic - 46-8-705 2660 · Gandalf Data - 46- 40-224460
Switzerland: Adcomp - 41-1-7414111 · Computer 2000 - 41- 42-659000
Turkey: Karma Ltd - 90-1-2597675
United Kingdom: Ideal Hardware - 44-81-390-1211 · Ingram Micro - 44-908-260160 • Sydec UK-44-628-487888 · Thame Systems - 44-844-261226

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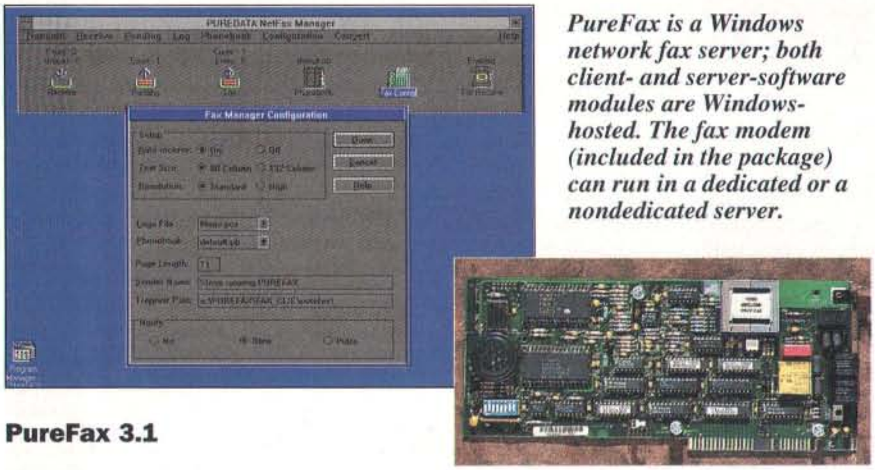
FAX_ADMIN and FAX_ROUTER NetWare groups.

There is a downside to this NetWare dependency. First, you must give fax access to the group EVERYONE on a server. Also, there is a one-to-one correspondence between file-server users and fax-server users, so shops with more file servers than fax servers will require some workarounds to provide access for each user.

Facsys provides Windows and DOS clients (which look and work very much alike), print-redirection services, and command-line utilities. Cover-page customization is a little inflexible; while you can install different default logos, you can't choose a logo for each fax.

You can switch the print redirectors between PRINTQ_FAX and local or other queued printers on the fly (as you can with the printer drivers that Calculus provides)—this means that you can leave the redirectors installed at all times and don't have to bother installing or uninstalling them. Users can also print directly to PRINTQ_FAX using PCL escape sequences for embedding phone numbers and other fax-specific information.

Incoming faxes can be manually routed, or you can use Facsys's OCR routing capability. The OCR engine scans the first page of each inbound document for a numeric string. We have seen it work; however, OCR is still a little too finicky for us to recommend using it on a regular basis.



PureFax is a Windows network fax server; both client- and server-software modules are Windows-hosted. The fax modem (included in the package) can run in a dedicated or a nondedicated server.

PureFax 3.1

Pure Data's PureFax is a pure Windows solution to the problem of faxing on PC LANs. Both PureFax's client software and its dedicated server program are Windows applications. They communicate with one another via a shared-directory structure, so PureFax will work on most any LAN operating system.

PureFax comes with its own fax modem, a Pure Data PDI9614 CAS-compatible board. The fax modem includes support for data, as well as fax transmission. Modem and software costs just $699, which makes it a real bargain compared to the other fax servers.

The server software consists of two modules: Faxres (a board-driver TSR) and Faxsuper (the main server and administrative Windows application). Faxsuper lets you define system parameters and user information. Faxsuper is well designed for use with NetWare, and you can put user information from the NetWare bindery into the PureFax user list.

Each PureFax user gets his or her own directory. The directory holds directed faxes, as well as user phone books and logos. As with other CAS-based products, you can switch between phone books at will.

PureFax users all share a common privilege level. There are no administrator- or router-class users. Instead, PureFax designates the user of the system console (i.e., Faxsuper, the application running on the server) as the administrative user. The Faxsuper user can configure the system (with the proper password) or view the first page of any document and route it to the appropriate user. Alternatively, you can have PureFax print every incoming fax or route every fax to a single user.

The ability to route faxes extends to anyone with access to Faxsuper. However, you can modify the system configuration only by getting into Faxsuper's password-protected Supervisor mode.

Windows clients can run a Windows application or print through a Windows printer driver. The Windows application provides a nice user interface, and we discovered sending and receiving faxes to be straightforward with PureFax.

continued

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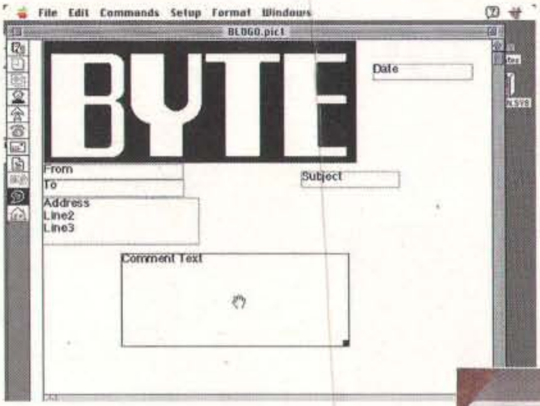
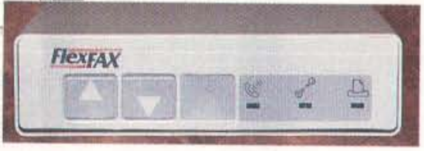
Fax Servers for Macs



4Sight provides a highly configurable cover page. The background is a PICT image; the foreground contains fields to be filled in at fax time. You can move and resize each of the fields using a mouse.



4Sight 2.0.3

This is industrial-strength faxing for the Macintosh. Circuit Research's 4Sight, a $2749 package (for 50 users), simplifies the administration and tracking of large numbers of users with high-volume fax requirements. 4Sight supports multiple servers within a network and multiple fax modems per server. Individual fax lines can be dedicated for incoming or urgent-only faxes.

4Sight's server communicates with its clients through E-mail—either through the built-in 4-Link or through Microsoft Mail or CE QuickMail. This removes the need to have an AppleShare server on the network for exchanging files. In addition, the fax server does not need to be a dedicated machine. When an application creates a fax, the client printer driver spools an intermediary-format file to disk and launches the 4-Link DA (desk accessory). (You can also use the 4-Link DA for composing stand-alone faxes.) At this point, you've constructed a mailable package that has a single enclosure (the document you just printed). To this, you add a cover sheet with the destination and possibly more documents (e.g., previously built fax images, text files, and PICT images). You can preview any of these file formats.

This package is mailed to the server, which images the cover sheet and translates the data into final fax format. Although this procedure returns control to the client workstation quickly, the fax itself can take a while to begin transmitting. Most of the packages we tested took 2 or 3 minutes to begin transmitting a complex Word document; 4Sight took over 6 minutes.

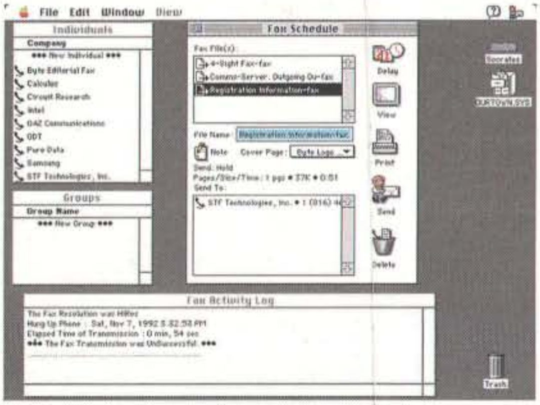
4Sight gives you complete control over cover-page layout. You can specify the size and location of the logo and any text field.

4Sight has its own list of authorized users, but the administrator can let 4Sight automatically add each LAN client the first time he or she attempts a fax transmission. Phone books are stored as tab-delimited files that can be easily manipulated by other programs.

Administrators can choose to select a new folder every day, week, or month, into which all archived faxes and logs are stored. This greatly simplifies administration of accounting and off-site archiving.

One minor drawback to 4Sight is its reliance on a particular modem in each of the countries it's sold in. The parent publisher, U.K.-based 4Sight, certifies a fax modem in each country. In the U.S., the modem is the FlexFax from Circuit Research. Circuit Research sells the bundle we tested. Among the features of the FlexFax modem is a large on-board buffer that can improve server throughput when controlling several modems.

Overall, 4Sight blends the strength of a GUI with the industrial guts required for a high-volume faxing environment. If you've got high-volume requirements on a Mac, get 4Sight.



A Faxstf administrator session showing phone books for individuals and groups. Fax status is dynamically updated and shows the state of the fax transmission queue.

Faxstf Net 2.2.3

STF Technologies' Faxstf Net, a shared-file fax server, requires an AppleShare server for client-/fax-server communication. You can run Faxstf on a nondedicated Mac, but STF recommends dedicating a server for heavy loads. The low-cost package ($249) provides fax services to all users (up to the limit of your AppleShare server) within a single network zone. Additional licenses are required for each zone in your organization.

The user interface is simple and intuitive. Although not as flexible as 4Sight, Faxstf lets you design cover pages quickly by pasting graphics into a template image. You copy a graphics image from a paint or draw program and paste it into a new or existing cover-page template. Text on the cover page is represented by a gray box that you can drag around for proper positioning.

You choose destinations by dragging names from the phone book into a destination box. In addition, you can send short notes of up to 255 characters using the Quickfax DA.

A printer driver redirects the output from any application to the fax server. You can choose the fax printer driver permanently from the standard Mac Chooser or temporarily through a user-configurable hot-key sequence. The hot key turns the normal Print and Printer Setup entries in the File menu into Fax and Fax Setup. If any other program (e.g., terminal emulation) tries to get hold of the serial port while Faxstf has control, the fax package relinquishes control until the other program terminates. We found this printer-driver interface the best of any of the packages we tested.

Shared files on the AppleShare server provide communication between users and

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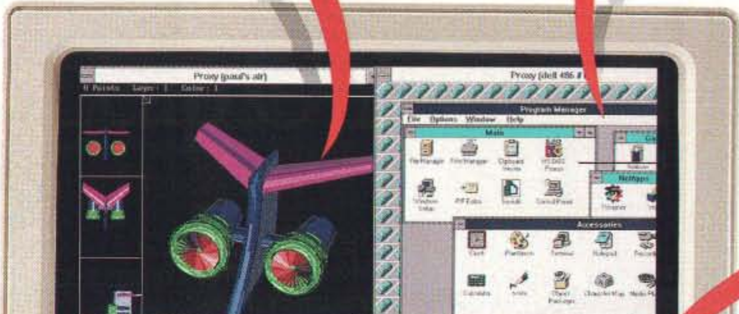

You can connect to multiple PCs over a network, with each appearing in its own window.

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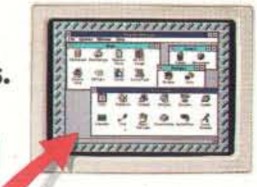

Proxy supports host computers running Windows.

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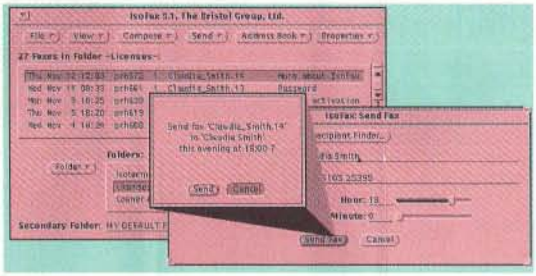
the fax server. Each client workstation images the document and deposits an assigned folder for it on the file server. The fax-server software periodically scans all the folders in search of unsent faxes. The client workstation images the fax body but leaves the imaging of the cover page to the server. This ensures that date and time stamps are based on transmission time, not on when the fax request entered the queue.

You can make Faxstf as unobtrusive or intrusive as you like. The default option is notifying you when a fax either is transmitted successfully or fails, but you can choose to be notified for different conditions.

Fax transmissions can notify you as soon as they are completed, or you can choose to check the activity log periodically to see if the transmission was successful. Client workstations maintain individual activity logs. Even though you can print these logs and export them to a variety of word processing formats, they can't be exported to any format importable by a spreadsheet or database. This makes integration with an automated accounting and analysis application difficult.

Faxstf receives incoming faxes; however, it does away with any routing problems by making all incoming faxes available to all users. This can cause serious problems for large organizations.

Fax Servers for Unix



Send fax 'Claudia_Smith.14' to 'Claudia Smith' this evening at 18:00 ?

IsoFax provides an Open Look client interface that lets you configure all the usual sending parameters, including delayed transmission. It also runs in terminal and command-line environments.

IsoFax 5.1

The Bristol Group's Isofax goes beyond most fax packages in its document management support. Besides the basic fax transmission and reception, IsoFax provides OCR on incoming documents and a searchable document management front end that lets you locate faxes based on user-entered keys, such as subject, date, recipient, and keywords. You can't search the cover-page quick message area, although this would make a good addition. You can search phone books by keywords.

IsoFax can run in three environments: command-line (scriptable), VT100 terminal (text-only screen), and Sun Open Look. This flexibility ensures that even remote users have the ability to compose and transmit fax messages.

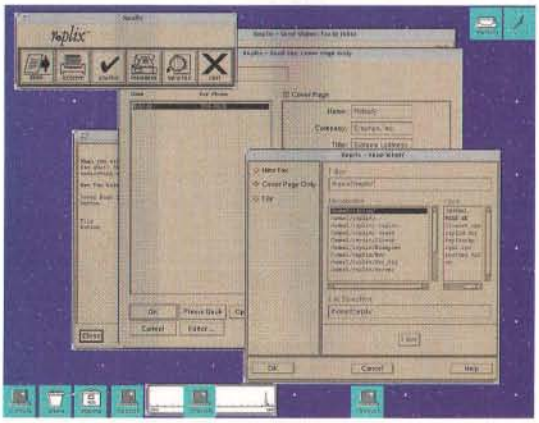
All Bristol's documentation is geared toward Sun workstations, resulting in a trouble-free, step-by-step installation. We had the system operational within half an hour of inserting the tape cartridge. Licensing is based on a floating-network license, simplifying administration. A 50-user system costs $3490.

You can compose faxes from a separate Faxtool application or fax directly from any X Window System application. Direct faxing requires that you select the xfax queue as your printer. When you print, a window appears that lets you select recipients and a cover letter.

Faxtool's fax composition method is the same in each environment. You select a sequence of files, consisting of cover page, text, PostScript, and Sun raster data, to be gathered into a single fax. You then select the fax's destination—either single or multiple recipients—and create a fax image that is transmitted to the server. ASCII files may be imaged either at screen-raster quality or by converting to PostScript fonts. Although slower, PostScript produces a somewhat higher-quality output. To save time with frequently faxed information, you can also include preimaged files.

Cover sheets may be either ASCII or PostScript source files. In either case, you define data fields, such as To, From, and Subject, through ASCII escape sequences. IsoFax does not provide any sort of interactive cover-page design utility.

Since you're assigned a separate fax directory, the operating system provides the security. Additional security is available by entering a key to scramble transmitted and received fax images.



The icon bar is the pivot point that Replix revolves around. Administrators and users share a common set of tools in the toolbar, but administrators have access to an additional administration icon.

Replix 1.0

Replix is Samsung's first foray into the world of Unix business software—and it's an excellent first effort. The terms *well-crafted* and *easy to use* paint an accurate picture. From the excellent documentation to the simple and obvious interface, this product is designed for ease of use. Yet behind this surface simplicity is a powerful engine we wish wasn't restricted to the Unix platform.

Replix can transmit faxes from a command-line or X Window System interface, or directly from third-party applications that produce ASCII or PostScript output through print capture. The X interface includes a simple text editor for quickly composing short faxes.

The stand-alone Replix application is a well-integrated, multiple-window interface that gives you access to all Replix functions. The fax administrator works within the same interface with an additional administration icon.

You can build faxes from ASCII, PostScript, and various bit-map format files. Once your fax is composed, you can view

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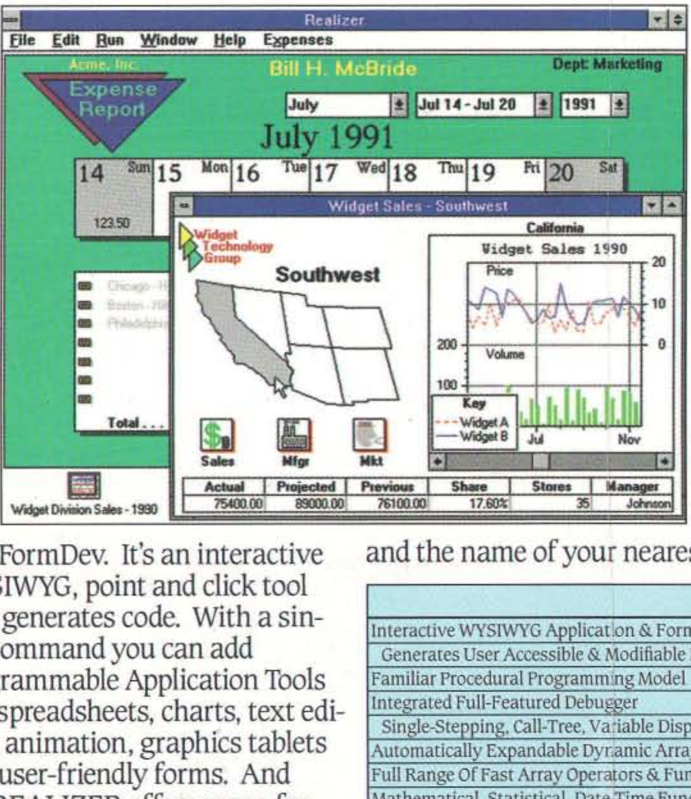
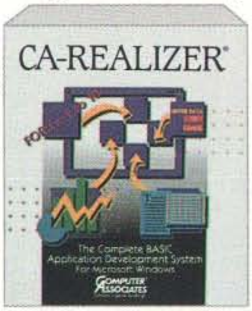


Actual	Projected	Previous	Share	Stores	Manager
75400.00	89000.00	76100.00	17.60%	35	Johnson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Full Range Of Fast Array Operators & Functions	✓	
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Dynamic Addition & Removal Of Form Objects	✓	
Fully-Integrated Programmable Application Tools:	✓	
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it and rearrange pages at will. Cover pages consist of PostScript files that contain ASCII escape sequences indicating key data fields such as To, From, and Subject. Cover sheets can include an optional signature graphic, which you can choose to include at send time.

In Replix, each fax has an owner. Even multiple users with the same name on different clients are differentiated. All outgoing faxes are stored in the same directory. However, individual users can see the status only of the faxes they own. Fax administrators (there can be several) can see and manipulate all faxes. Both users and administrators can run queries against the fax list specifying keys such as date, time, user, or recipient.

Incoming faxes are also stored in a single directory. Once faxes are received, a fax administrator must route the fax to the proper destination. This is done in one of several ways. The administrator can simply change the ownership of the fax, so the addressee will see it when next checking the fax status. Or Replix can send an E-mail message indicating that a fax has arrived. Alternatively, you can send the entire fax via E-mail.

Replix contains a set of hooks that allow integration of custom applications. Events such as a send or retrieve request, phone-line access, or fax reception act as triggers. A simple example of a custom application would be to send E-mail to a particular fax administrator noting the time of day whenever a new fax was received.

Unfortunately, no single fax server will serve every network environment.

At $6713 for a 50-user license, Replix is rather expensive. It is, however, powerful, capable, and—most surprising—easy to use, even for nontechnical users.

Fax Populi

Obviously, the fax-server market is filled with capable packages. Unfortunately, no single fax server will serve every network environment, and the most powerful packages don't have the best client interfaces. And as we mentioned earlier, none of these packages supports mixed DOS/Windows, Macintosh, and Unix clients.

We ended up choosing our favorite packages on a variety of criteria—some for strong client support, and some for scalability and ease of administration. However, each of the packages we chose was at least among the easiest to use on its platform.

For NetWare networks, you can make a very good selection from among Alcom's LanFax Redirector, Intel's Net Satisfaxtion, Cheyenne's Fax-serve, or Optus's Facsys. For PCs running on non-NetWare LANs, LanFax Redirector is the best choice, although Pure Data's PureFax makes a good economical server.

Of the Mac packages, Circuit Research's 4Sight is the more capable package in large organizations, even though we preferred the interface STF Technologies' Faxstf provides. Finally, despite its newcomer status, Samsung's Replix is the best package we have seen for Unix networks. ■

ACKNOWLEDGMENT

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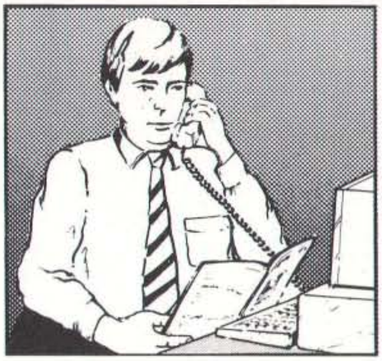

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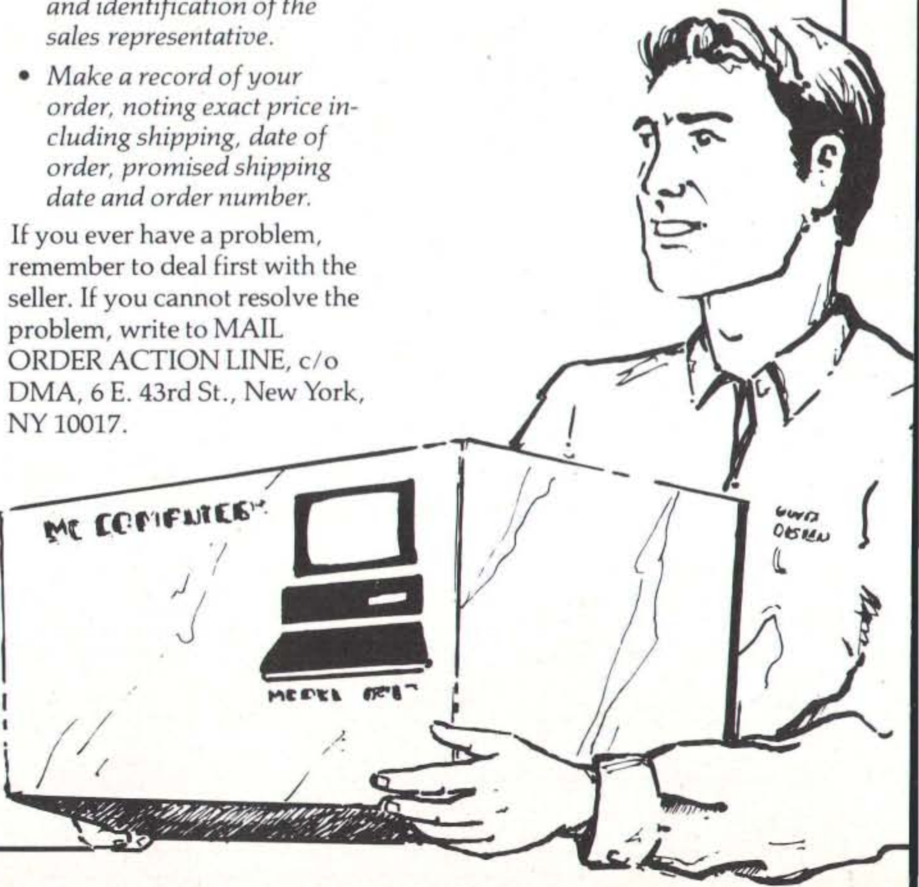

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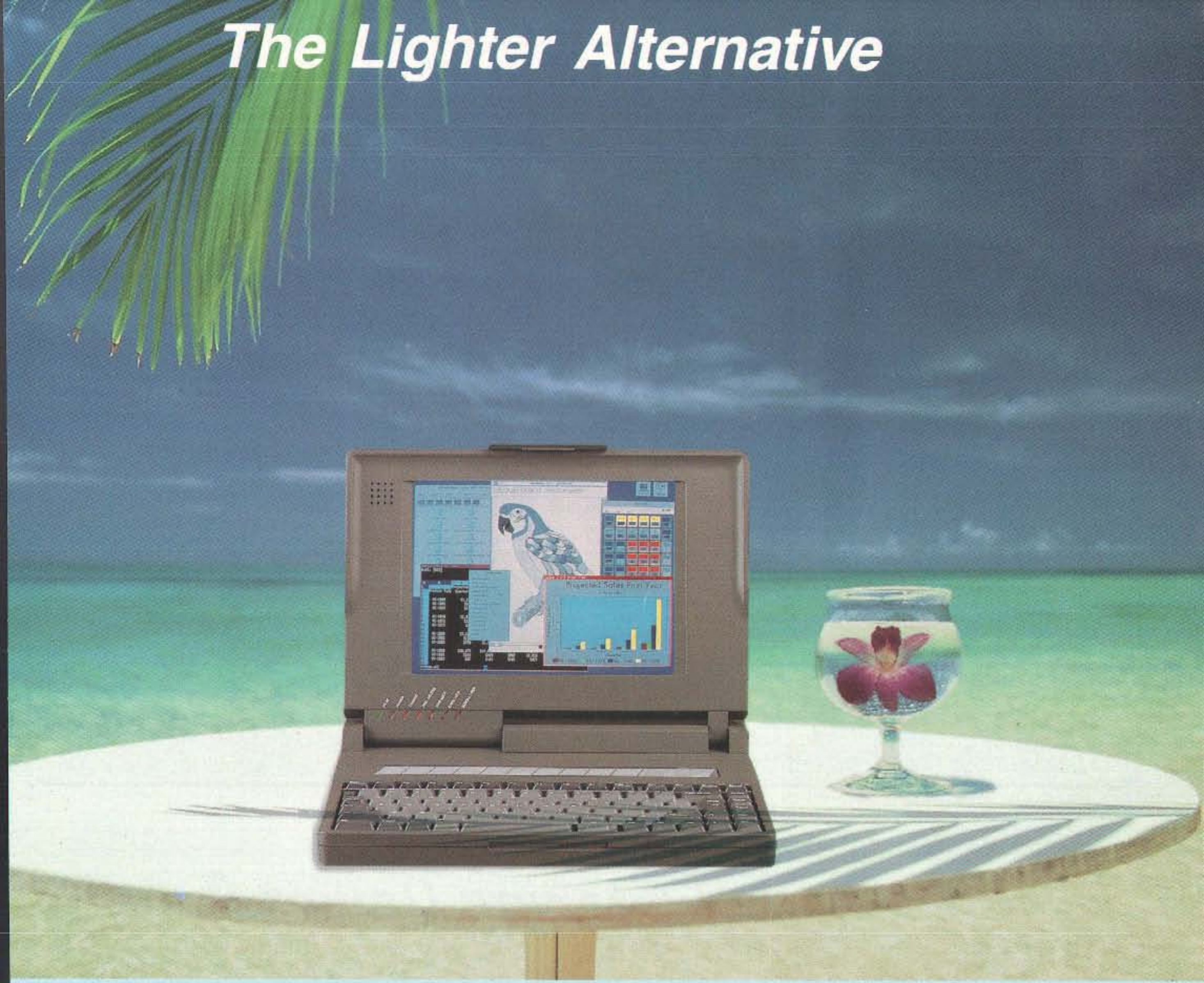

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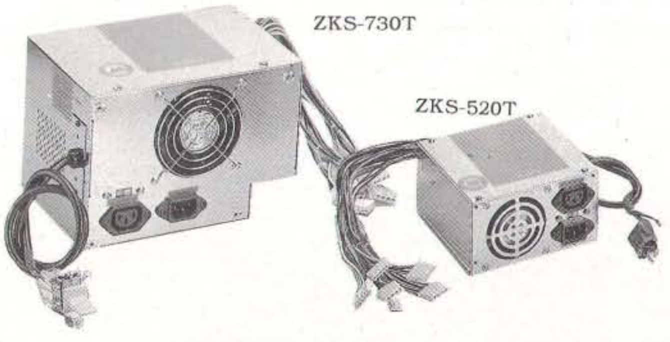

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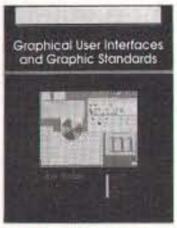

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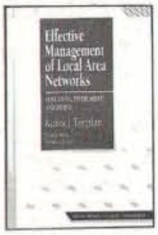

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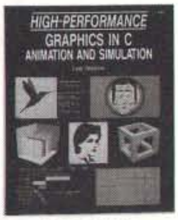

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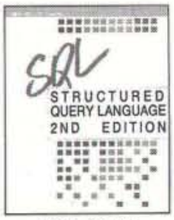

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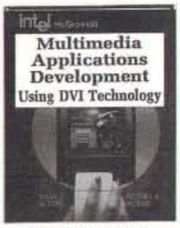

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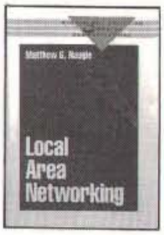

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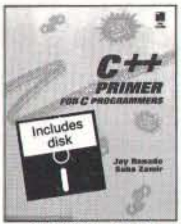

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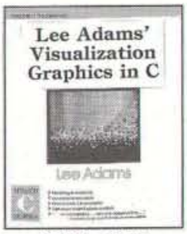

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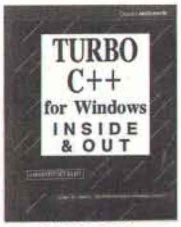

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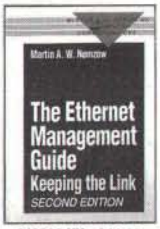

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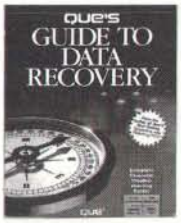

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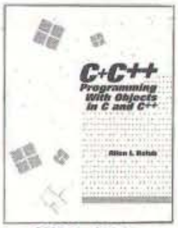

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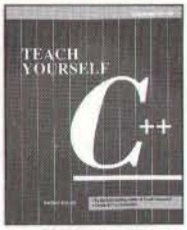

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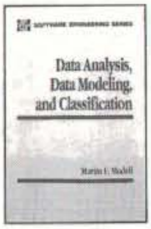
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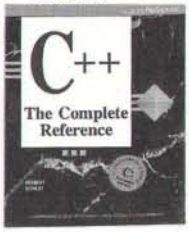

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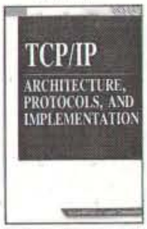

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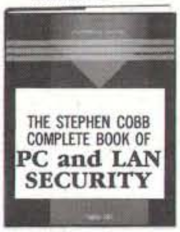

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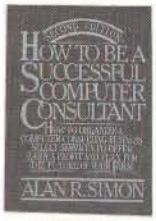

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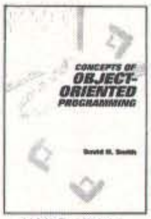

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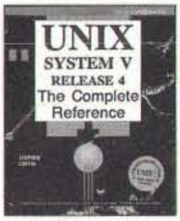

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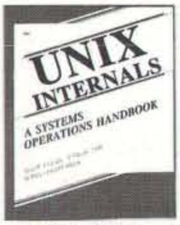

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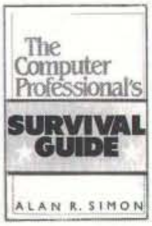

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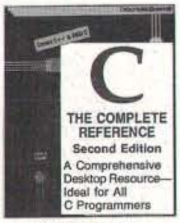
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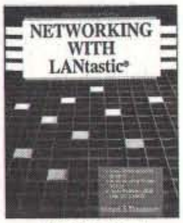

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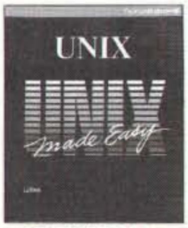

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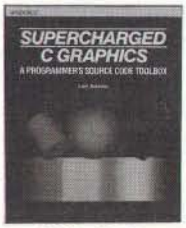

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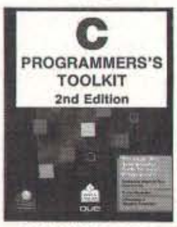

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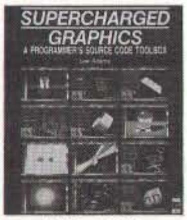

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BYTE REVIEWS

HARDWARE

New Tricks for Slow Macs

RICK GREHAN

If your love affair with the Macintosh has cooled because your 68000- or 68020-based machine doesn't run today's software or does so in a painfully slow manner, a Mac accelerator board may rekindle the flame. There are now dozens of accelerator boards on the market that can upgrade your system with 68030 and 68040 CPUs running at 25, 33, and even 50 MHz. In addition, these accelerator boards can provide math coprocessors for systems that never had them before. The result is a faster Mac that's suitable for today's applications for an upgrade cost of between $250 and $1700 (depending on the Mac model you have).

For this roundup, I evaluated 17 Mac accelerator boards designed for systems ranging from the new Performa 400 to the aged Mac 512K. All but one of the boards can be installed by end users (the exception is the Brainstorm, for the Mac Plus). In addition to the Brainstorm, I looked at products from Applied Engineering, DayStar Digital, Dove Computer, Extreme Systems, Fusion Data Systems, Harris Laboratories, Impulse Technology, MacProducts USA, Mobius Technologies, System Technology, and Total Systems.

Performance Indicators

When choosing a Mac accelerator board, you must make sure it has the right combination of performance and features for your applications. The text box "When to Upgrade" on page 202 describes the advantages of the 68030 and 68040 CPUs as well as the 68881 and 68882 floating-point processors. The table shows the benchmark results of each accelerator board running the BYTE Lab's latest version of its Macintosh benchmarks (for more information on the benchmarks, see this month's Reviewer's Notebook). The table also shows pricing, compatibility, and other essential information about the boards.

As you examine the boards' performance and features, consider what special requirements you may have. Do you need a number cruncher? If so, an accelerator board with a high FPU index should be your first pick. How about a large-screen monitor? One of the boards that come with a video adapter could be the best choice. Finally, compare the price you'd pay for an accelerator board to the cost of buying a new Mac. With the low prices of today's Macs, you may find it's more economical to trade in your 68000-based system for a newer model.

My Macintosh test-bed represented a good sampling of the available Mac models. I used a Mac Plus, SE, SE/30, LC II, II, IIci, and IIsi. The features table shows which accelerator boards support each Mac model. Most of the boards run in more than one Mac model either as is or with an adapter card.

Some manufacturers produce an entire line of accelerator boards, each targeted at a different Mac platform. One example is the DayStar PowerCache, which can plug directly into a IIci or a Performa 600. With an adapter card, the PowerCache will fit into a Classic, SE, SE/30, LC, LC II, II, IIx, IIcx, IIsi, or Performa 400. Quite a chameleon act.

Installation

Adding an accelerator board always starts with opening your Mac. In general, it is more difficult to upgrade a Plus, Classic, SE, or SE/30; this is due largely to their construction. Successfully popping open one of these Macs is right up there with shucking an oyster: It's not easily done without the right tools.

Unhooking all the cables from the motherboard requires no small amount of contortions as you seek to avoid the stem of the CRT and the exposed components of the power supply (again, this is especially true for Pluses, Classics, and SE-class machines). Dangerous voltages are afoot, even for a period of time after you have unplugged the system. So, it's important to remove metal watchbands, bracelets, rings—anything conductive that might inadvertently make you part of a circuit—before you begin. Plan on spending about an hour upgrading a Plus, Classic, or SE machine. And don't forget to bring your torx, a case-cracking tool, and a couple of screwdrivers.

Getting into other Mac models is a cakewalk by comparison. You simply remove one screw on the back of the machine and pop off the top. On average, you can install an accelerator board in these models in

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BYTE ACTION SUMMARY

- **WHAT MAC ACCELERATORS ARE**
  Add-on boards that boost the performance of your Macintosh. Most accelerator boards provide an optional FPU; some increase memory.

- **LIKES**
  Performance improvements for virtually all applications.

- **DISLIKES**
  For owners of Pluses, Classics, and SE-class machines, installation can be an ordeal. Even some Mac II installations require chip-pulling.

- **RECOMMENDATIONS**
  The Gemini Ultra is a top choice for speeding up a bare-bones SE. For out-and-out speed, choose the Performance/040.

about a half hour. Possible installation snags may arise. For example, if you install the Voyager 030 in a Mac II, you must detach the drive platform and pry the CPU and PMMU (paged memory management unit) chips from their sockets.

However, don't let these apparent dangers keep you from considering the possibility of getting an upgrade. Many manufacturers offer free installation.

Board Configurations

Most of the accelerator boards I tested were 68030-based; a smaller number were 68040-based, while the Performer2 and the ever-unique Brainstorm used a 68000. All the 68030 boards were socketed to accept a 68881 or 68882 FPU, and all the units I tested had 68882 coprocessors installed. All the 68040 cards have no need for an FPU socket, because they use a version of the CPU with an integrated FPU. (The 68000-based Performer2 comes with a 68881 coprocessor.)

The Mobius accelerator boards for the SE and Classic, as well as the Vandal SE, RailgunPro 030, and (optionally) the Gemini Ultra for the SE, also include graphics adapters as part of the accelerator hardware. This lets you connect displays that are larger than 9 inches to Mac SEs and Classics.

Some accelerator boards, especially those for the Classic and SE, carry SIMM sockets for holding memory local to the board. This on-board memory keeps up with the faster processor without a lot of wait states. For example, the Gemini Ultra can take your SE from its ordinary maximum of 4 MB to a previously unheard-of 64 MB (ideal for memory-hungry graphics applications or a big RAM disk).

The Software Side

The installation software that comes with the boards usually uses a control panel design. For the 68030 boards, this control panel program consists of a simple dialog box with on/off switches that let you enable or disable the CPU's instruction and data caches. As I'll discuss later, this plays an important role in compatibility.

The 68040 boards' control panel software typically allows you to select cache modes: copyback, write-through, or none. With the TokaMac boards, the control panel lets you choose only copyback or write-through modes. A cache running in copyback mode is fastest: Data written to the cache is written to main memory only when it's absolutely necessary. Hence, the processor is less frequently burdened

MAC ACCELERATOR BOARD FEATURES AND BENCHMARKS

The benchmark results shown below are normalized to the performance of a 4-MB Mac SE/30; see text for further details. For installation difficulty, easy = you simply open the top of the machine and plug in the accelerator board; moderate = some cabling is necessary; hard = you must pull chips, perhaps do some soldering, and attach additional cables. (N/A = not applicable.)

	Brainstorm	Gemini Ultra	Impact	MaraThon Racer	Mobius	Performance/040
Systems available	Plus	Plus, SE, 512K	LC, LC II	Classic, SE	SE, Classic	II, IIx, IIcx, IIci, IIfx, IIsi
Systems tested	Plus	SE	LC II	Classic, SE	Classic, SE	IIsi
Price	$249	$1018	$698	$599	$594 (SE); $644 (Classic)	$1750 (25 MHz); $2399 (33 MHz)
Processor	68000	68030	68030	68030	68030	68040
Processor speeds (MHz)	16	20, 33, 50	32	16	25	25, 33
External CPU cache	None	None	32K	32K	None	None
Coprocessor	None	882	882	882	882	N/A
Maximum RAM	N/A	64 MB	None	None	16 MB	128 MB
Software	None	A, B, C	C	C	A, B, C	E
Video adapter available?	No	Optional	No	No	Yes	No
Warranty	1 year limited	1 year	1 year limited	90-day replacement	2 years parts/labor	1 year limited
Installation difficulty	Hard	Moderate	Easy	Moderate	SE: moderate; Classic: hard	Easy
BENCHMARKS						
CPU speed tested (MHz)	16	50	32	16	25	33
CPU index	0.5	2.1	1.3	Classic: 0.8; SE: 0.7	Classic: 1.3[1]; SE: 1.3	2.6[1]
FPU index	0.3	10.3	5.7	Classic: 1.8; SE: 1.8	Classic: 4.3; SE: 3.8	14.5

Notes:

[1] One or more benchmark applications could run only if some of the board's features were disabled (see text).

[2] Mathcad failed to see the board's FPU.

Software key:

A = RAM disk
B = Copy ROM to RAM
C = Faster SANE
D = Patch for 68040
E = Application/cache tracking

with the additional CPU cycles of writing to external memory. Write-through mode, as its name implies, sends data to the cache as well as to main memory, so the processor suffers a slowdown with every write operation. (Note that copyback and write-through modes do not apply to the instruction cache; this is a read-only cache.)

Some accelerator boards carry their own RAM on-board for the CPU to directly access. However, this causes the RAM that's already on the motherboard to go largely unused. Consequently, many accelerator boards come with software that creates a "crash-resistant" RAM disk in the motherboard RAM. Here, *crash-resistant* doesn't mean that the RAM disk is invulnerable; if you turn your machine off, the information is indeed lost. Instead, the RAM disk is crash-resistant in the sense that if a program dies and takes your Mac with it, you can reboot using the programmer switch and the RAM disk will be intact. Depending on the amount of memory you're able to allocate to the RAM disk, it could be an ideal place to put things like temporary files that your application creates, the HyperCard Home stack, and so on.

To maximize performance, some accelerator boards copy ROM to the accelerator's RAM at start-up. You get a boost from this option because ROM has a longer access time than RAM. Moving the code to RAM means that the frequently executed Toolbox routines in ROM can be run from the faster RAM.

FPU Considerations

Many of the accelerator boards that come with FPUs offer software that patches the Mac's SANE (Standard Apple Numeric Environment) calls to provide faster floating-point operations. Some go beyond simply redirecting floating-point calls from SANE routines to the FPU itself. For example, the Transwarp CI board comes with software that implements what Applied Engineering calls '882 Express. When '882 Express is active, it bypasses routines in Apple's SANE package that check the results of the FPU for accuracy. When this accuracy checking is unnecessary (it apparently takes place only for some of the trigonometric functions), '882 Express should result in improved performance.

As good as caching and ROM-copying sound, they don't always work. Some software simply won't work with caching enabled. This is not a fault of the accelerator board; it's what happens when the board tries to run software written by programmers who weren't thinking ahead to these days of cached, high-speed 68xxx CPUs. For example, I was unable to run PageMaker 4.0 on the TokaMac boards with the cache in copyback mode.

Most compatibility problems are linked to the CPU cache and occur frequently in programs that execute self-modifying code. (See this month's Reviewer's Notebook for more details.) Many accelerator board manufacturers provide a list of incompatible applications and, in some cases, tell you how to solve the problem.

Other manufacturers take a more active approach to solving incompatibilities.

Performer2	PowerCache	Quik30	RailgunPro 030	TokaMac	Transwarp CI	Vandal SE	Voyager 030
Classic, SE	SE/30, LC, LC II, II, IIx, IIcx, IIsi, IIci, Performa 400 and 600	SE	Plus, SE, Classic	IIci, LC, SE/30, IIsi	IIci	SE	II, IIx
SE	IIci	SE	SE	SE/30, IIci	IIci	SE	II
$249	$1599	$795	$899 (SE)	$1695	$1265	$699	$1509
68000	68030	68030	68030	68040	68030	68030	68030
16	33, 40, 50	16, 25, 33	16, 25, 33	25	50	33, 50	33, 50
96K	32K	None	None	None	64K	None	64K
881	882	881, 882	881, 882	N/A	882	882	882
None	None	16 MB	16 MB	None	None	16 MB	8 MB
None	C	A, B	A, B	D	C	B, C	A, B, C
Soon ($149 extra)	No	No	Optional	No	No	Yes	Optional
Lifetime	3 years limited	2 years parts/labor	1 year parts/labor	1 year (hardware)	1 year	1 year (hardware)	1 year
Moderate	SE/30: moderate; II, IIx, IIcx: hard; others: easy	Moderate	Moderate	Moderate (SE) to easy	Easy	Moderate	Hard
16	50	33	33	25	50	33	50
0.5	2.3	1.7	1.5	SE/30: 1.87[1]; IIci: 2.2	2.2	1.6	1.9
0.7[2]	7.5	5.3	4.6	SE/30: 3.85; IIci: 5.43	7.7	7.6	8.2

For example, the 68040-based TokaMac boards come with a program called Multipatch that searches an executable file for code that uses 68020/68030 cache-clearing instructions and replaces them with their 68040 equivalents. The Performance/040's control panel lets you build a *compatibility list*. This is a list of software package names and an associated compatibility rating, which indicates which cache mode the software can run (copyback, write-through, or none). When you launch a program, the Performance/040's software checks the compatibility list and automatically sets the cache mode appropriately.

Often, however, you have to resort to experimentation. If your application blows up, you must turn off features one at a time until the program starts working again. Then when you've identified the feature that creates the problem, you reenable the other features one by one, verifying each time that the program still executes. This is a lot of work, but it's worth it for applications that you use frequently.

It's also possible that you'll have to update your applications to run in accelerated mode. For example, to run Microsoft Word 4.0d on the Performance/040, you have to disable the cache. However, Word 5.0 will run on the Performance/040 with the cache enabled and in copyback mode.

If all else fails, you can always run your system in its unaccelerated mode. All the boards I tested (except for the Brainstorm) let you boot your system so that it appears to be operating with its original hardware. In most cases, you reboot the machine by pressing the reset and interrupt switches in a particular sequence. Since the Brainstorm actually alters components on your Mac Plus's motherboard, a Brainstormed Mac Plus is forever accelerated.

Lab Tests

The BYTE Lab's application and low-level benchmarks exercise all components of the system—graphics, CPU, FPU, and disk. I focused on those tests that would most likely indicate a system's CPU and FPU power. Since I was testing the boards on a variety of systems with differing disk and graphics systems, it would be unreasonable to compare, for example, the database scores of one accelerator board to those of another.

I ran all tests under System 7.0.1. For systems that support a color monitor, I reduced the display depth to monochrome. For those accelerator boards that support on-board RAM, I ran them with 4 MB on the accelerator board (usually, this meant that I needed to have 4 MB on the system board). Otherwise, I ran them with 4 MB on the motherboard. (The exception was the Voyager 030, which ran with 8 MB in a Mac II.)

To derive a CPU index, I took the results from the BYTE Microsoft Word tests, PageMaker tests, Think C tests, and low-level CPU benchmarks. The index is simply the nonweighted average of the times normalized against the results taken for an unaccelerated SE 30. The FPU index is composed of results from the BYTE Mathcad tests, Excel tests, and low-level FPU benchmarks. I got the number using the same technique I used for the CPU index.

continued

When to Upgrade

Does having a faster CPU or FPU justify the time and expense of upgrading? Here's a sketch of the benefits offered by the latest members of the 68000 family.

68030 Essentially an integration of the 68020 CPU and the 68851 PMMU (paged memory management unit). The 68030 includes a 256-byte data cache as well as a 256-byte instruction cache. The 68030's predecessor, the 68020, included only an instruction cache.

The primary advantage of the 68030 is that it's faster than its predecessor due to caches and burst-read mode (used to rapidly fill the caches from main memory). The 68030's integral MMU also lets you use virtual memory under System 7.0 or run A/UX (a 68020 CPU with a 68851 PMMU also accomplishes this, but the communications between the two chips adds overhead).

68040 Integrates a 68030 with a 68881-/68882-compatible FPU. In addition, the instruction cache is extended to 4 KB, and an independent 4-KB data cache is added. Internally, there are multiple independent execution pipelines, so the integer unit (the CPU), FPU, and MMU can be executing simultaneously.

As with the MMU on the 68030, moving the FPU on-chip in the 68040 improves floating-point performance. The heavy-duty parallel processing inside the CPU enables it to process instructions much faster than the 68030. Finally, the large caches operated in copyback mode mean even faster execution because off-chip bus traffic is minimized.

68881/68882 FPUs. Each coprocessor has eight internal floating-point registers. Both conform to the ANSI/IEEE 754-1985 standard. The 68882 provides increased throughput via simultaneous execution of some floating-point instructions and special-purpose hardware for converting to and from the FPU's internal format.

While the SANE (Standard Apple Numeric Environment) software can handle floating-point processing without special hardware, it does so by executing hundreds of instructions, which take time to execute. Dedicated FPU chips accomplish the same processing in silicon and at a much faster rate. If you require lots of number crunching, budget for an FPU (or the 68040 CPU with a built-in FPU).

As mentioned earlier, some accelerator boards ran into compatibility problems running the applications (although none had any problems running the BYTE low-level benchmarks). The result was typically a bomb box reporting a bus error or an illegal instruction error. When that happened, I would repeatedly try to rerun the application, each time disabling one of the accelerator board's features until the application ran. Then I reenabled those features that did not cause the application to crash.

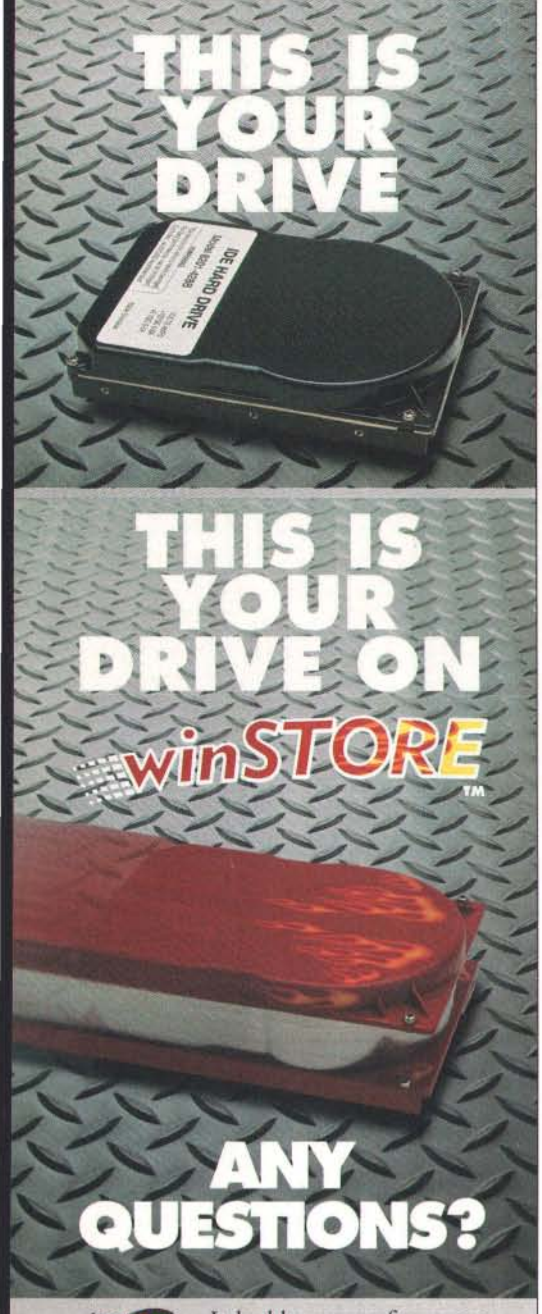
Sometimes the application refused to execute unless I completely disabled the accelerator board. In such cases, rather than run the test in nonaccelerated mode, I simply left that component out of my calculations of the index. (I did, however, note those cases where compatibility problems arose.) Indexes are listed in the table.

Top Accelerator Boards

I found it difficult to make generalizations about the value of individual boards because performance is so application-specific. It seems more appropriate to make a variety of recommendations. For my money, the Gemini Ultra is a top choice for speeding up a bare-bones SE. Not only does it let you take the SE up to a whopping 64 MB, but you can also tack on the optional video adapter and add a large-screen monitor. The board's no slouch, either, turning in the highest CPU index for SE upgrades and the second-highest FPU index of all the accelerator boards I tested.

For pure speed, the Performance/040 scored highest. I shouldn't let pass, however, the fact that the Performance/040 had some difficulties running some of the BYTE benchmark applications—Word 4.0 and Adobe PageMaker 4.0, for example.

continued



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As I mentioned earlier, the 68040 doesn't always get along with some applications, so for mission-critical ones, contact Impulse Technology for a compatibility list.

Finally, for sheer ingenuity, I liked the Mobius board as an upgrade for the Classic. The wraparound design of the board and sneaking the external monitor connector through the Classic's grill indicates an engineering department with a tenacity that deserves some kind of recognition. ■

Rick Grehan is technical director of the BYTE Lab. You can contact him on BIX as "rick_g."

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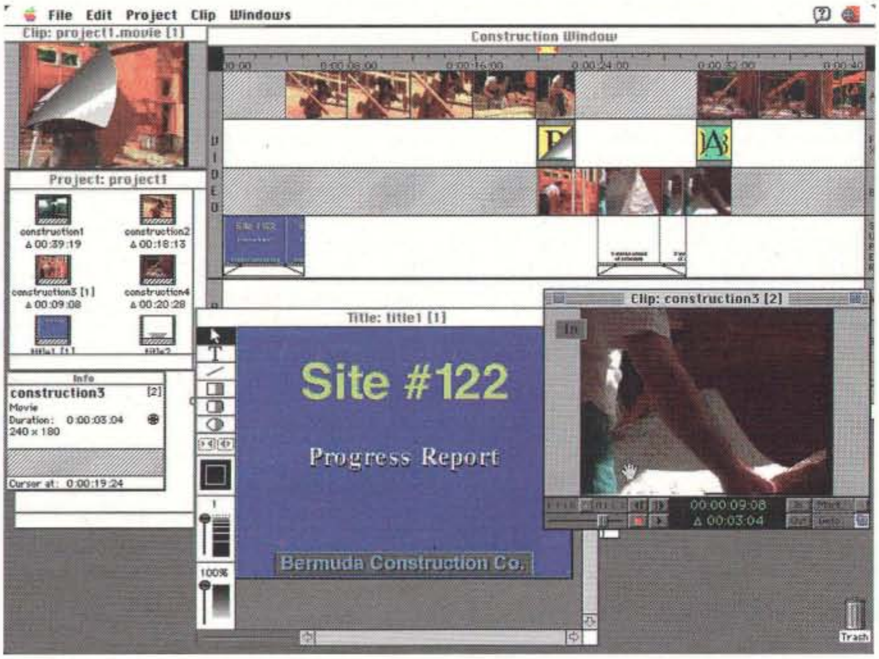
APPLICATION

The Second Premiere

TOM YAGER

There is every reason to expect that Premiere 2.0, Adobe's QuickTime movie-editing system, will cause as much commotion as the original package did when it started shipping a year ago. Back then, Premiere was the first such application, but it was only one of many pieces Macintosh users required to create a complete QuickTime movie (see "Two Tools of the QuickTime Trade," June 1992 BYTE, and "Cut to Video: Four Programs for Moving Presentations," November 1992 BYTE).

The new Premiere brings more of those pieces together in one package. Version 2.0 has its own video-capture module and titler. It also offers remote control of video decks, and it can export EDL (edit decision list) files for use in full-size editing suites. These additions help make digital video affordable for those who now use analog video or who long for the versatility of broadcast equipment but can't justify the cost.



Info
construction3 [2]
Movie
Duration: 0:00:03:04
240 x 180
Cursor at: 0:00:19:24

Premiere's interface is dominated by the construction window. Video and audio clips are mixed according to their relation to each other on the time line, the placement of transitional effects in the FX track, and attributes such as motion and keying.

Building the Set

Premiere 2.0 runs on a Mac IIci or better with 8 MB to 20 MB of memory and a 24-bit graphics card. Premiere will run under System 6.0.7, but System 7.x is preferred. I tested Premiere on both a Mac IIci with an Apple 8•24 GC graphics card and a Quadra 700 with a SuperMac Spectrum 8•24/PDQ graphics card. I ran the IIci with a total of 8 MB of memory. The more powerful Quadra carried a total of 20 MB. I used the SuperMac VideoSpigot, a leading QuickTime capture board, in both test systems.

The Quadra supports digitized audio; I had to equip my IIci with Macromedia's MacRecorder Sound System Pro, an external sound digitizer that plugs into the serial or printer port. The Quadra's audio input is microphone-level; I had to use an attenuating patch cord to make the line-level output of my Panasonic AG-7650 Super-VHS VCR usable.

As it stands, the best that either the internal or external Macintosh audio-digitizing solutions can offer is 22 kHz at 8 bits. Support for 44-kHz audio is supposedly on its way from Apple, and a future upgrade to QuickTime and Sound Manager will bring high-quality audio to Premiere.

Makeup

Premiere's main interface hasn't changed much since the original release. The landscape (see the screen) is dominated by a construction window, in which you assemble tracks of video and audio. Adobe added a preview window in version 2.0, so you can now see a single assembled frame from any point in your sequence. Also new is the movie-capture window. It shows the capture board's input in real time (for focusing, tape positioning, and other adjustments) and provides the interface through which you set various recording preferences.

For the movie-capture feature to work, Premiere requires a VDIG (video digitizer) that matches the capture board you're using. This provides a device-independent layer that Premiere and other QuickTime applications can use to build in capture capability with minimal hassle. Premiere doesn't ship with VDIGs; they all come from capture-board vendors. At press time, VideoSpigot's VDIG was still in beta testing, but fully functional.

Premiere's capture interface calls out to the VDIG not only to capture video but also to adjust the capture board's settings, select the frame rate and compression method, and otherwise tune the capture system. Video can also be brought into Premiere in real time or one frame at a time. If you connect your Mac to a VCR through VISCA, Diaquest, V-LAN, or another supported video transport control interface, Premiere automatically steps through a video and captures it frame-by-frame. You can then use Premiere to digitally edit that video and record it back to a single-frame-capable VCR one frame at a time. It's a time-consuming operation, but the resulting video is of much higher quality than with real-time capture and playback, and it becomes the rough equivalent of an editing suite for those long on patience but short on cash.

The Cutting Room

To edit video, you drag a clip into one of the construction window's tracks. There are three tracks of video (titles and graphics count as video) and three tracks of audio. You can mix the audio tracks any way you like. You can alter the playback volume of each audio track over time by moving points on a graph for cross-fades and other dynamic effects. If a video clip has attached audio, they are locked in sync and placed together in the construction window. Stand-alone audio clips containing music, narration, or sound effects can be dragged in and aligned with any location in your video.

Transition Choices

Mixing video tracks is more involved. There are two main video tracks (A and B), and one "super," or superimposition, track. The A and B tracks are mixed according to their overlap, and icons are dragged into the FX (transitional effects) track. A cut edit is arranged simply by butting the end of one clip against the beginning of another (in either the same or different tracks). If A and B overlap, an FX icon can be placed between them to arrange a transition.

The transitions are varied, running the gamut from simple wipes and dissolves to page turns and cube spins. You can gain a more professional look by adding colored borders and antialiased edges to transitions that use moving shapes. When appropriate, transitions can be adjusted to create unique effects. A zoom transition can be stopped in the middle, for example, for a picture-in-picture effect.

BYTE ACTION SUMMARY

- **WHAT ADOBE PREMIERE 2.0 IS**
  Software for capturing and editing QuickTime movies.
- **LIKES**
  Professional features like VCR control and multiple key modes; instant preview; impressive selection of effects and filters.
- **DISLIKES**
  Filters can be applied only to an entire clip; poor interface to some features; weak titler.
- **RECOMMENDATIONS**
  Premiere is still the best choice for QuickTime editing, and 2.0's new features give it a broader audience.
- **PRICE**
  $695 (upgrade from 1.0, $149)
- **FOR MORE INFORMATION**

Adobe Systems, Inc.
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Mountain View, CA 94039
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fax: (415) 962-0850
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The primary duty of the super track is handling titles and overlaid graphics. Premiere has a versatile software keyer that simulates many functions provided by broadcast video keyers, including chroma (color) and luminance (brightness) keying and image mattes (video is played through a text or graphical shape). One particularly exciting key mode is the difference keyer: It compares each frame of video to the one before it and makes everything that doesn't move transparent. So if you shoot a basketball game with a stationary video camera, you can extract just the parts that move (the players and the ball) and lay them in front of another video source.

Motion effects, a new feature, let you animate the movement of a video or graphics clip through the viewing area. The animation follows a path you create, and at each point in the path you can apply rotation, scaling, and distortion to create wonderful pseudo-3-D effects.

In addition to transitions and key effects, you can apply filters to video clips to change their appearance. There are 41 filters in all, and most of them are special-effects oriented. You can create an undulating dream-sequence effect, make your video ripple like waves in a pond, or spin your video into its center like water down a drain. More practical filters handle tinting and colorization, gamma and color correction, and color filtering.

Weak Links

Unfortunately, filters are one area where Premiere 2.0 falls short. Its filters change the clip's contents directly, and they can only be applied to an *entire* clip. I found that limiting: I wanted the freedom to drag out a section of a clip and apply a filter to it (a competing package, Diva VideoShop, allows this). You can easily split a clip into two clips and apply a filter to one of them, but that's an awkward workaround.

Another Premiere flaw is an ironic one: It has so much power that some of it is hard to find. You can, for example, make a video clip fly in from a corner, spinning and tumbling as it comes. I would expect to do that as part of a transition, but that's not how it works. Instead, you have to apply a motion effect to a clip and then superimpose it to create a transition from scratch. That's typical of Adobe tools: Between Illustrator and Photoshop, you can accomplish almost anything you want, but you can also make a career of learning how.

The final weak link in Premiere is its integrated titler. Premiere creates very nice-looking antialiased text (antialiased in the alpha channel, no less), but it comes up disappointingly short in other areas. All colors must be solid—no patterns, image maps, or gradations are allowed. But you can specify a transparency level. Text cannot be rotated or scaled (even though Premiere includes Adobe Type Manager), and the only available effect is shadowing. The integrated titler is better than nothing, but it seems Adobe would prefer you use Illustrator to create more interesting titles. It doesn't fit with the rest of Premiere's professional features.

Once you have lined up everything—video, audio, and effects—you can use the preview window to look at any section of your project. You can view either a reduced-rate moving preview or a snapshot of a particular frame. The snapshot is extremely helpful because you can instantly see whether the transition or superimposition effect you've chosen works as you expected.

When you are satisfied with what you see in preview mode, you can generate a finished QuickTime movie of your job. At this point, you can see your work at the frame rate and resolution you choose, and you can apply your choice of video compression techniques. If you're dissatisfied with any of the results, you can feed the movie back into Premiere for additional editing.

Digital Partner

Premiere 2.0 is a welcome partner for those who use digital video but who aren't ready for more expensive, more capable digital nonlinear editing systems. The program's ability to control external video equipment and output EDLs not only helps Premiere fit into existing video studios but gives all its users room to grow.

The application doesn't do everything, or do everything right, but it remains the standard against which other QuickTime editors are judged. The quality of the material Premiere pumps out (provided you create your titles elsewhere) is as good as QuickTime can manage. Premiere may take some learning to use well, but it's time well invested. ■

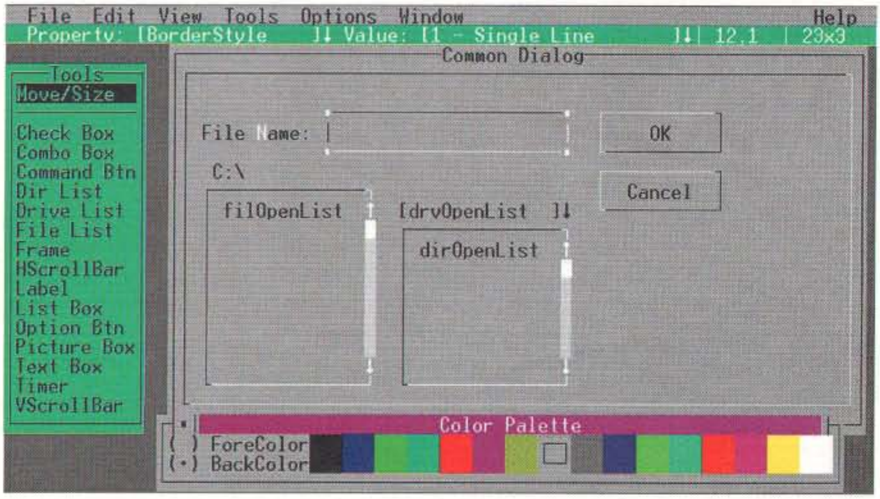
Tom Yager is director of BYTE's Multimedia Lab, a multimedia consultant, and the author of The Multimedia Production Handbook for the PC, Macintosh and Amiga *(Academic Press, forthcoming). He can be reached on BIX as "tyager" and on the Internet at tyager@bytepb.byte.com.*

SOFTWARE

A BASIC Breakthrough

TOM YAGER

Microsoft's new Visual Basic for DOS may earn converts among those bigoted against BASIC. This is a programming system unlike any other (except perhaps Visual Basic for Windows). In one box come all the tools you need to write *serious* BASIC applications. The standard edition ($199) features an integrated environment—editor, interface builder, debugger, compiler—and a set of interface objects for building professional-looking applications. The professional edition ($495) adds features that seasoned Microsoft BASIC programmers expect, like ISAM (indexed sequential-access method), graphics, overlays, and 386/486 optimizations. And this package offers one feature that is truly hard to find: near-automatic conversion to Windows.



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File Name:

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VBDOS's interface builder will set existing DOS developers to drooling. The interface elements are all "smart"; buttons know how to change shading when they're pressed, text boxes know how to handle and edit input, and so on. The interface model should look familiar: It's Windows.

Power Tools

I evaluated the professional edition of VBDOS on a handful of systems, including a Dell 450SE 486/50 tower and a Toshiba T2000SX notebook. This gave me a good feel for its performance. One of the most significant aspects of the program is the integrated environment. It, like the programs you create with it, delivers to a remarkable degree the Windows look and feel in text mode. If it weren't for the jumpy reverse-video block that's supposed to be the mouse cursor, the emulation would be almost complete.

Developing applications under VBDOS is a lot like using its Windows counterpart. VBDOS is a highly modular system in which each separable block of code is edited in its own window and proper programming style is *enforced*. Start a new function definition under the one you've just written, and VBDOS will instantly open a new window and move your function definition to it. If you just keep typing, you won't even notice.

This is important when you're editing large, multimodule applications. The environment knows all the function and subroutine names you've used and can pop up some named portion of your code in a flash. If your project has multiple files, VBDOS lists the files in a box on the right side of the display, so you can hop from module to module with ease. You no longer have to remember which file the function you're looking to edit is hiding in. You can have multiple edit files open at once or, to save screen space, do all your editing in a single edit window that switches from file to file.

The Big Event

VBDOS programs should be event-driven if you wish to take full advantage of the environment's power. Most events come from user-interface objects, and the interface builder is an integral part of the VBDOS system. Interfaces are drawn in much the same way as with Visual Basic for Windows (see the screen). Double-clicking on an interface object brings up the BASIC code attached to that object. Code segments are mostly attached to interface objects' events (like mouse-clicks and key presses).

The objects are "smart"—that is, they have designed-in behavior that you don't need to program. The text object, for example, already knows how to process text. If you drop a bunch of different interface controls together in a window, VBDOS assigns a default tab order so users can move among them with the tab or arrow keys. All you really have to add is code describing the action you wish to take in response to the input events you choose to pay attention to. Any input not actively processed by your code is discarded. This is a boon for prototyping and testing interfaces as you build your application.

continued

BYTE ACTION SUMMARY

- **WHAT VISUAL BASIC FOR DOS IS**
  An integrated environment for creating compiled, event-driven DOS applications with BASIC.
- **LIKES**
  Suitability for all classes of programmers; Windows portability.
- **DISLIKES**
  Interface support for DOS text mode only; overlays required to get past 640 KB.
- **RECOMMENDATIONS**
  It's the one programming tool you can't live without.
- **PRICE**
  Standard edition, $199 ($99 for Microsoft BASIC owners); Professional edition, $495
- **FOR MORE INFORMATION**
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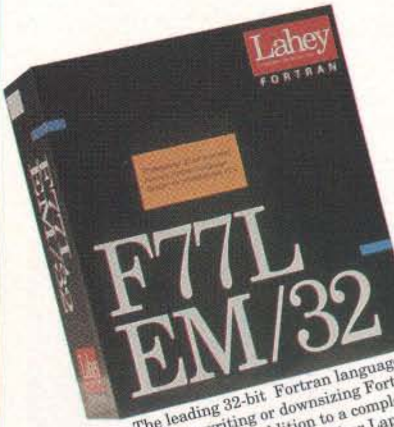

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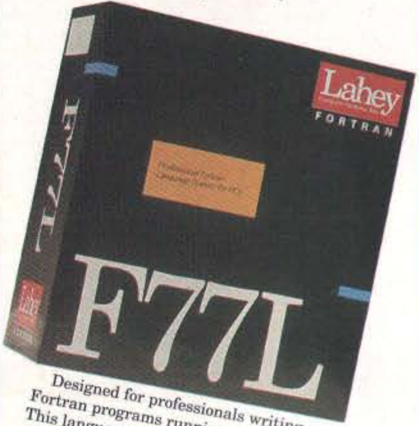

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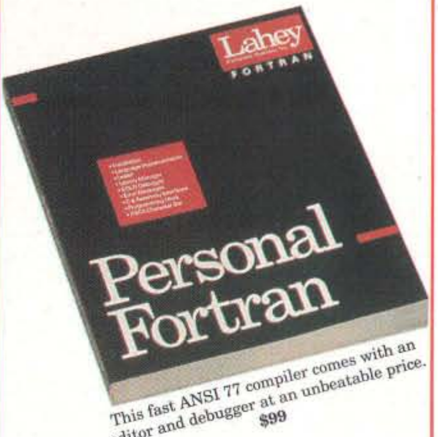

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DOS text-mode limitations on screen space and memory become apparent when you start switching between the code and interface-building portions of VBDOS. If you go from the integrated environment to the interface builder, for example, the screen goes blank for a few seconds, and then the interface builder appears. The integrated environment goes away until you exit back to it. This is the only place where the integration comes apart. I had been developing in Windows for so long that I forgot all about DOS's shortcomings and the dirty tricks required to work around them. The VBDOS executable will use EMS or XMS (Extended Memory Specification) high memory as swap space if you tell it how much it can use at launch time.

Multiple Goals

In releasing VBDOS, Microsoft has several groups to please: Windows developers who also want their programs to run under DOS (and vice versa), experienced QuickBasic and Microsoft BASIC developers, and people who don't normally write their own programs.

VBDOS directly supports taking a Visual Basic project from Windows to DOS; since the DOS version came last, Microsoft was able to build Windows file compatibility into it. To go from DOS to Windows involves either saving individual form (i.e., interface) and code module files as ASCII or running the whole shooting match through a Windows-based project translator (included with VBDOS).

All the standard interface elements are supported on both sides, and the underlying languages are almost identical. Microsoft even provides DOS clipboard and printer objects that support enough functionality to make porting go more smoothly. Perhaps more remarkably, the Windows MDI (Multiple Document Interface) is emulated. Most small projects just translate on the first try, but it depends mostly on how many Windows- or DOS-specific things you try to do. Custom controls and extensions (like ISAM) on either side are not portable, but that's to be expected. What brings it all together is the marvelous documentation: A well-written appendix covers conversion in both directions and spells out the issues.

Microsoft also goes out of its way to accommodate QuickBasic 4.5 and BC 7.x users. The manual includes a detailed accounting of the differences between Microsoft's BASIC languages (including GWBASIC) and offers lots of ways to work around those differences. QuickBasic and BC code can be loaded directly; unlike Visual Basic for Windows, the DOS version will run virtually any old-fashioned, non-event-driven BASIC program with a minimum of adaptation. Smart programmers, however, will take the manual's advice and convert instead of copy to take advantage of the new features Visual Basic places at their disposal.

Eyes of the Beholder

The "visual" aspect of Visual Basic for DOS is more than skin-deep. VBDOS applies advanced software development techniques in a unique combination that DOS programmers haven't experienced before. I'm a Visual Basic for Windows fan, so I expected to be disappointed by the DOS version. Not only was I impressed, but I realized that VBDOS has some key advantages over its Windows counterpart. These include a native-code compiler (with optional 386/486 optimization). In addition, DOS programs have the advantage of running under Windows as well (they run very nicely in the Windows DOS box). Other benefits are the professional edition's integral ISAM database support and the software's ability to build applications into single-file stand-alone executables.

Although there's a lot about VBDOS that's impressive, it does have shortcomings. First, I would have liked better support of DOS systems running in graphics modes. This would have made some limited multifont capability available, with a trade-off in display performance (this mode can be seen in Microsoft Works for DOS). It might also have made for better support for graphical elements like icons and window border controls.

I would also like to see more transparent support for extended memory. As it is, you must resort to overlays and command-line tools (specific to the professional edition) in order to get your applications over the 640-KB hump. That makes large Windows programs difficult to port and heavy-duty DOS applications more work than they have to be.

Overall, I think Microsoft hit the nail right on the head. VBDOS adequately meets the needs of serious and casual programmers, Windows and DOS programmers, and BASIC and other-language programmers. I can't think of a class of the code-writing public whose lives wouldn't be made easier with this system. If Microsoft keeps this up, it'll give BASIC a good name. ■

Tom Yager is director of the BYTE Multimedia Lab and a proud BASIC programmer from way back (but he also writes in C). He can be reached on BIX as "tyager" or on the Internet at tyager@bytepb.byte.com.

APPLICATION

Forging a Business Tool: Three Fax Software Packages for Windows

STAN MIASTKOWSKI

I've used fax software on and off for several years, and I have usually been disappointed. It was often difficult to set up and use, and the results were mixed. In large part, Windows-based fax software has changed that. This new generation of fax software makes computer-based faxes an essential business tool.

For this review, I looked at three packages that just came out: Eclipse Fax, Caere FaxMaster, and ZSoft UltraFax. All three sell for under $150, and they give you a good idea of the range of products (with very different abilities) available today. (The latest version of Delrina's WinFax, which is among the best-selling fax programs, wasn't finished as this review was being written. The final version should have shipped by the time you read this.)

Each of these packages lets you send faxes from your Windows (not DOS) applications by automatically installing a fax driver in Windows' printer section. As with all Windows printer drivers, you can set the fax drivers as your default printer or use the Printer Setup pull-down menu in your Windows application to choose the fax driver.

When you want to send a fax, you choose the Print option from your application. All Windows fax packages pop up a screen where you enter the destination phone number, the recipient's name, and the subject of the message. All these packages give you the option of attaching a cover sheet and have built-in phone books, where you can store lists of names, addresses, and fax numbers.

If you want to send a quick one-page fax, all the programs offer a direct-send Memo feature. The fax driver intercepts the print output, converts it to a graphical fax image, and sends it on its way. All three packages offer automatic fax reception that you can switch on and off, but you'll need a fax modem that will receive and send faxes (not all do).

All the packages include a View feature that lets you see a fax on-screen before deciding if you want to print or store it. And each package lets you integrate an external scanner for importing pages that aren't stored in your computer. Finally, further underlining the fact that Windows and fax software are made for each other, if you're running Windows in the enhanced mode or using a modem with its own processor (see below), you can work in an application while a fax is being received or sent in the background.

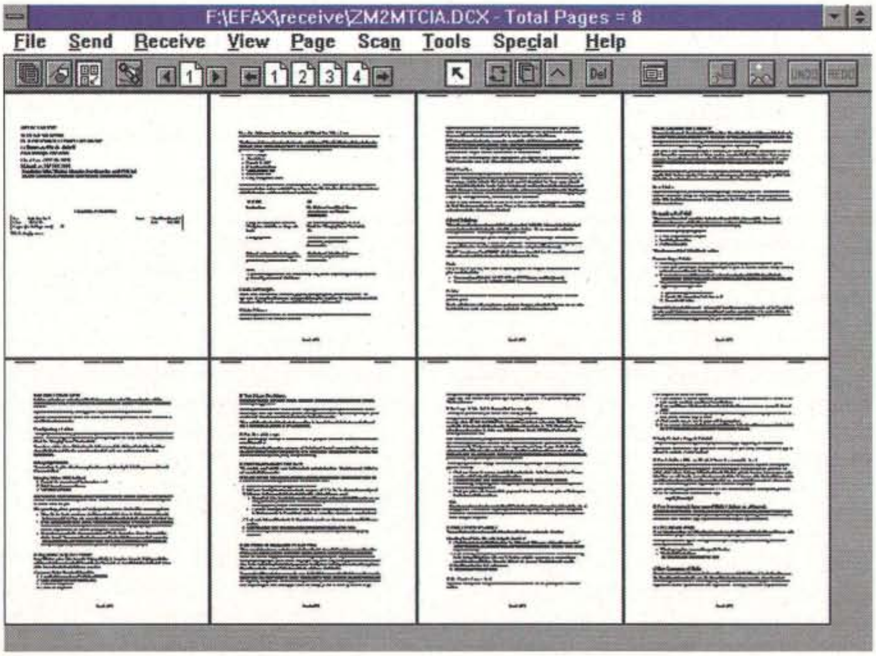
A word to the wise: Fax programs don't stand alone. It's advisable to invest in the best fax modem you can afford. If you need to fax many documents that aren't in your computer, you'll also need a scanner, which can cost more than a high-quality stand-alone fax machine. The bottom line is that the cost of a fax program is only a small part of the expense you incur when you set up a computer-based fax system. However, if they match your needs, programs like these can give you a highly integrated fax setup that can save you time and money.

I tested these fax software packages using an Intel Satisfaxtion Modem/400e internal unit and a SupraFaxModem V.32bis external unit. The Intel Satisfaxtion is an add-in card with its own 186 processor and RAM, taking the fax send/receive chores away from the PC's processor. It also conforms to CAS (Communications Applications Specification). The Supra unit is a class 2 (i.e., send/receive) fax modem, where the fax software communicates directly with the modem.

Eclipse Fax

When you launch Eclipse Fax, you see a plain screen with five pull-down menus. I found this simplicity useful and elegant, because you get the information you need without overloading your brain. When a fax is being received, a small screen pops up to tell you the status of the fax. Ditto for when you are sending one.

Nevertheless, there's intelligence and some unique features hidden behind the plain face of Eclipse Fax. For instance, the program offers an indexing feature that's useful if you store a lot of short faxes. When you receive a fax, you can enter a name (up to 50 characters) in the index box. It's essentially an extended filename, not a true database, but it's eminently useful. As you receive and store more faxes, you can scan through the list and quickly



Screen 1: *Eclipse Fax offers a straightforward user interface and the ability to show a thumbnail of a received fax.*

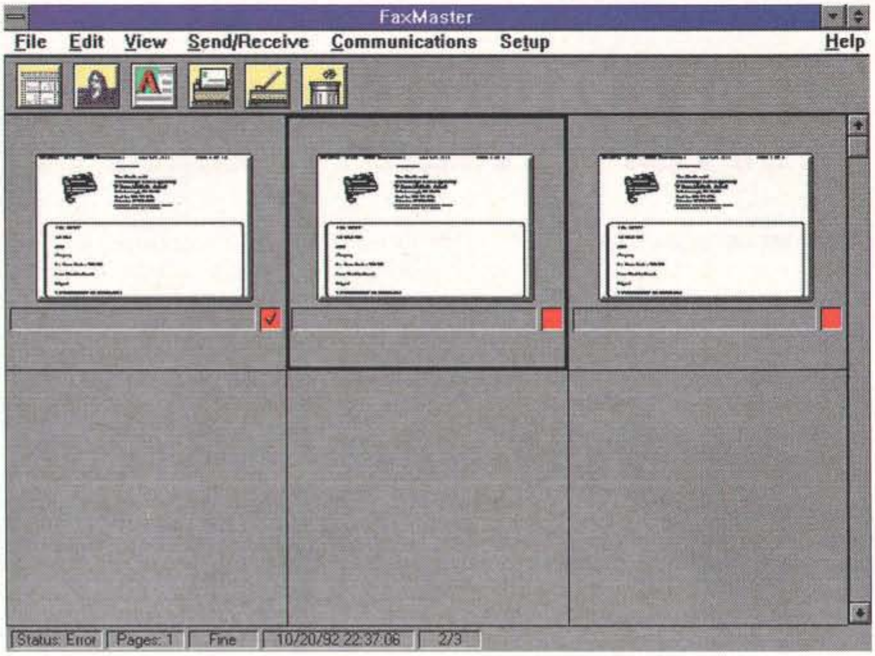
find the fax you want to retrieve.

Eclipse Fax's View option is fast, displaying faxes on the screen almost instantly (see screen 1). Most other packages can take from a few seconds to several minutes to go through the translation step before displaying the fax, depending on how long the fax is and how fast the PC is.

Another nice feature of Eclipse Fax is that it lets you annotate faxes in the View mode. If you want to type comments on the received fax before storing it or returning it to the sender, you just position the cursor and type away. You can also use drawing tools to mark up the fax.

Eclipse Fax uses Clearview technology. This feature removes miscellaneous spots and lines from the fax and enhances characters that didn't come through completely formed.

The package requires only a half-megabyte of disk space, the smallest amount of the three applications I reviewed and a size that allows it to work well with a portable computer. But unlike the other two programs covered in this review, Eclipse Fax doesn't include OCR (optical character recognition), so it won't translate the words in your received faxes into ASCII.



Status: Error | Pages: 1 | Fine | 10/20/92 22:37:06 | 2/3

Screen 2: *Caere FaxMaster hides advanced abilities (including patented character-recognition technology) behind a highly integrated icon-oriented user interface.*

Caere FaxMaster

With FaxMaster, Caere is branching out from just OCR products to full-fledged applications. FaxMaster is definitely the company's flagship application.

As you would expect, FaxMaster focuses on converting received faxes into computer-readable form. If you receive many long faxes that must be edited or rewritten, FaxMaster can save you a lot of time. You can set up the program to automatically convert a fax when it's received or to perform the process later. Faxes can be converted to ANSI, ASCII, Microsoft Excel text, or Microsoft RTF (Rich Text Format). You can use the program's direct-input feature to insert a converted fax into the application (and file) of your choice.

The program's interface is highly graphical, with six icons for common operations (e.g., viewing printing, scanning, and recognizing faxes). Since many faxes are viewed and discarded quickly, FaxMaster provides a handy trashcan icon for immediate deletion. I like that. (See screen 2.)

FaxMaster requires almost 4 MB of disk space. A large part of that is the OCR engine, which Caere dubs AnyFax.

FaxMaster's image-recognition abilities are impressive. I sent it a page produced by desktop publishing software that included several fonts and various type sizes. I even tried to confuse it by placing several graphics on the page. FaxMaster identified and blanked out the graphical images and performed text recognition with a high degree of accuracy.

However, fax conversion requires a lot of processing horsepower. The OCR process was an order of magnitude faster on my 33-MHz 486 than on a 16-MHz 286.

The higher the quality of the received fax, the more accurate the recognition process is. The page I produced with desktop publishing software and sent to FaxMaster was sent from the application through a fax modem to another fax modem using the fine mode (i.e., 200 by 200 dots per inch). FaxMaster easily performed an accurate translation with a direct fax-modem send using the standard fax mode (200 by 100 dpi). However, FaxMaster had problems with a typewritten page that was sent from a well-used standard fax machine. That's not the program's fault. FaxMaster's image recognition is impressive and useful, but don't expect miracles if it receives a noisy or streaked fax.

Caere offers a compression feature dubbed SuperCompression that's handy if you store faxes rather than convert them to text. A fine-mode fax that's a few pages long can take up a megabyte or more of disk space, because it's essentially a large graphical image. SuperCompression uses a proprietary method of compressing images. Caere claims that this feature produces a compression ratio of up to 33 to 1. SuperCompression works, and it's useful, especially if your hard disk is rapidly running out of space, like mine.

continued

BYTE ACTION SUMMARY

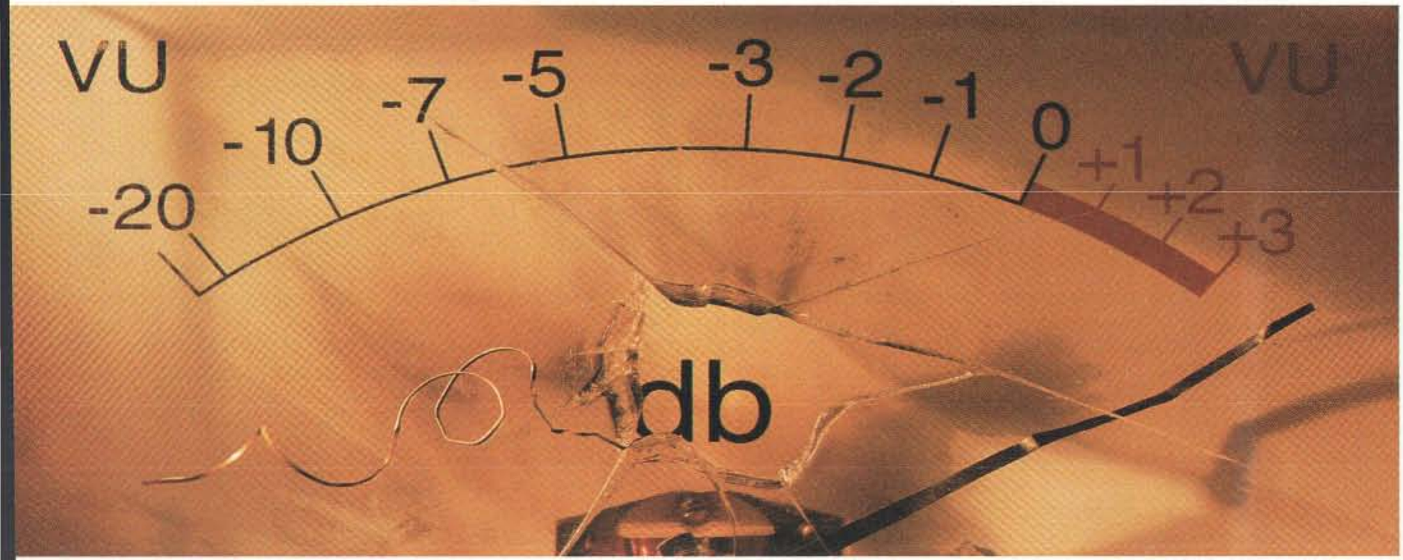
- **WHAT WINDOWS FAX SOFTWARE IS**
  Windows-based programs that let you send faxes from your Windows applications by printing to the fax modem. You can also receive faxes in the background.

- **LIKES**
  This software lets you view faxes on-screen; some translate the graphical image of a fax into computer-readable ASCII.

- **DISLIKES**
  Most programs require a large amount of disk space, and some make extensive changes to your Windows system files.

- **RECOMMENDATIONS**
  Choose Eclipse Fax for simplicity and low disk-space requirements; Caere's FaxMaster excels for those who need OCR to convert faxes to ASCII text.

Allow us to crank up the volume on your PC.



Just when you thought you had us pegged for building fiery-hot graphics cards we decide to throw a curve ball. And this one's aimed directly at your ears: the new Orchid Sound Producer ro. An easy-to-load board that features a phenomenal 20-voice synthesizer, delivers sampling rates up to 4.1 KHz and is 100% compatible with SoundBlaster Pro, along with three other sound standards—Disney ound Source, AdLib and Covox Speech Thing. MIDI support, joystick port, microphone, speakers nd our exclusive Voice Notes (for audio post-its) are bundled for an absurdly low $199. For more etails, call 800-7-ORCHID. Or fax: 510-490-9312. And prepare to sample true audio ecstasy.

ORCHID

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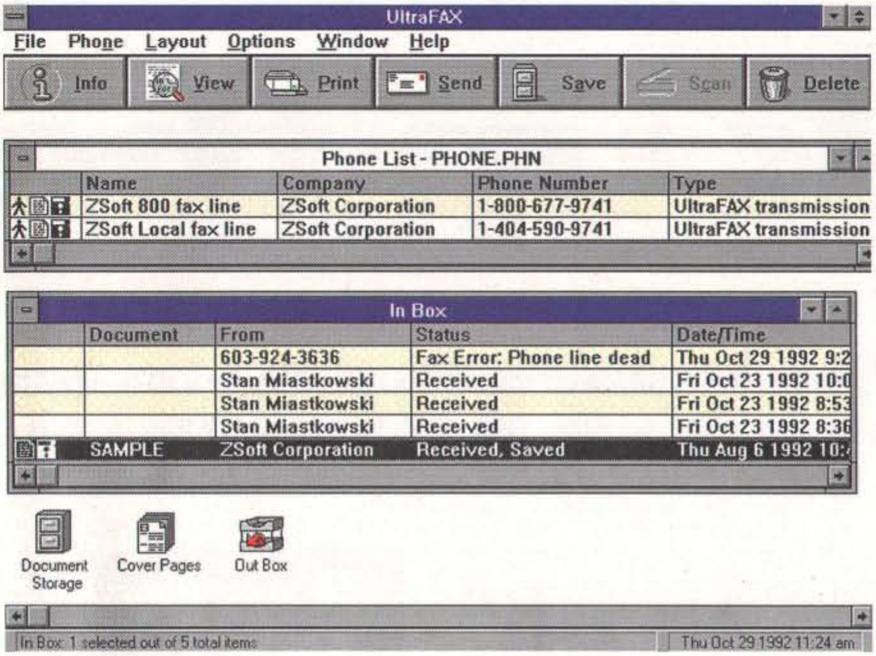
Circle 111 on Inquiry Card (RESELLERS: 112).



Name	Company	Phone Number	Type
ZSoft 800 fax line	ZSoft Corporation	1-800-677-9741	UltraFAX transmission
ZSoft Local fax line	ZSoft Corporation	1-404-590-9741	UltraFAX transmission

Document	From	Status	Date/Time
	603-924-3636	Fax Error: Phone line dead	Thu Oct 29 1992 9:2
	Stan Miastkowski	Received	Fri Oct 23 1992 10:0
	Stan Miastkowski	Received	Fri Oct 23 1992 8:53
	Stan Miastkowski	Received	Fri Oct 23 1992 8:36
SAMPLE	ZSoft Corporation	Received, Saved	Thu Aug 6 1992 10::

In Box: 1 selected out of 5 total items

Thu Oct 29 1992 11:24 am

Screen 3: *ZSoft UltraFax integrates a lot of information on its main screen, and it includes character-recognition abilities.*

ZSoft UltraFax

Integrating useful features into an application *and* making it easy to use isn't a simple process. ZSoft's UltraFax is the largest program of the three I've reviewed here, requiring over 4.5 MB of disk space. It has a raft of features, but many of them aren't obvious.

UltraFax has a complex user interface; however, to its credit, it has nice big buttons on the main screen for common operations (including a trashcan; see screen 3). You can customize almost anything in UltraFax, including the look and feel of in boxes and out boxes.

> **UltraFax has a raft of features, but many of them aren't obvious.**

ZSoft developed the popular PC Paintbrush graphics program, and UltraFax has numerous graphics abilities. Just as with Eclipse Fax, you can draw on and annotate faxes. There's also a large selection of cover-page templates, ranging from the serious to the near-ridiculous.

UltraFax is unique among these three packages because it can import existing databases and export phone books to other programs. Other useful features in UltraFax include the ability to send binary files (at 9600 bps) to other computers running UltraFax. There's also a handy archiving feature (not unlike the one in Eclipse Fax) that allows you to index stored faxes.

UltraFax also offers OCR. Its accuracy doesn't match Caere's software. UltraFax's line-by-line character recognition was slower and more easily fooled than FaxMaster's, and it required a high-quality, direct-send, fine-mode fax to achieve a high degree of accuracy.

Of the fax programs covered in this review, only UltraFax makes extensive changes to your Windows WIN.INI and SYSTEM.INI files. That's not unusual among Windows applications in general, but one of my pet peeves is installation programs that neither make backups of the Windows system files nor give you an "uninstall" option that puts everything back where it was. UltraFax does neither, and I spent a lot of time changing and cleaning up files after I finished my review.

Making a Choice

The range of Windows-based fax programs available today gives you many choices, depending on how many faxes you send and receive and what you want to do with them.

For simplicity and usefulness, Eclipse Fax is the obvious choice. If you have to convert faxes into computer-readable text files, choose Caere's FaxMaster for its outstanding OCR technology. ■

Stan Miastkowski is a BYTE consulting editor and a freelance writer. He can be seen regularly on the "PCTV Live!" syndicated TV show and is the coauthor of Windows for Workgroups Bible *(Addison-Wesley, forthcoming). You can reach him on BIX as "stanm."*

ITEMS DISCUSSED

Eclipse Fax..............................$119
Eclipse Systems, Inc.
33 West Monroe St., Suite 1121
Chicago, IL 60603
(800) 452-0120
(312) 541-0260
fax: (312) 541-0514
Circle 1229 on Inquiry Card.

FaxMaster..............................$149
Caere Corp.
100 Cooper Court
Los Gatos, CA 95030
(408) 395-7000
fax: (408) 354-2743
Circle 1230 on Inquiry Card.

UltraFax..................................$119
ZSoft Corp.
450 Franklin Rd., Suite 100
Marietta, GA 30067
(800) 227-5609
(404) 428-0008
fax: (404) 427-1150
Circle 1231 on Inquiry Card.

FAX MODEMS

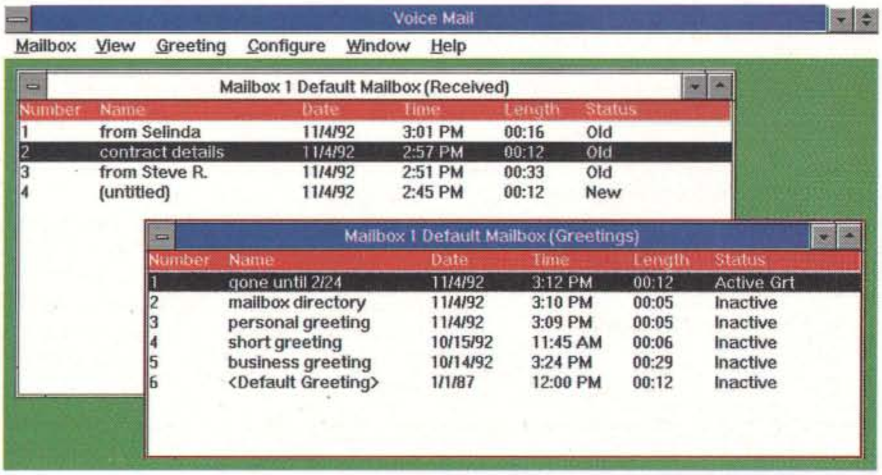
Intel Satisfaxtion Modem/400e..........................$549
Intel Corp.
5200 Northeast Elam Young Pkwy.
Hillsboro, OR 97124
(800) 538-3373
(503) 696-8080
Circle 1232 on Inquiry Card.

SupraFaxModem V.32bis..$399.95
Supra Corp.
7101 Supra Dr. SW
Albany, OR 97321
(800) 727-8647
(503) 967-2400
fax: (503) 967-2401
Circle 1233 on Inquiry Card.

HARDWARE

Complete Communications for Small Businesses

STANFORD DIEHL

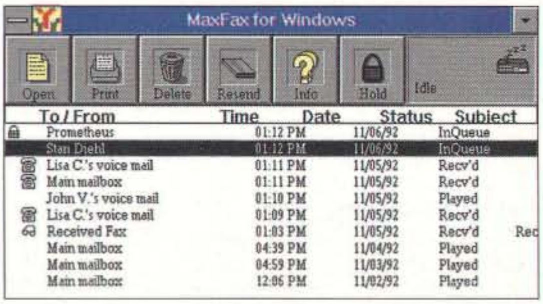


Mailbox 1 Default Mailbox (Received)

Number	Name	Date	Time	Length	Status
1	from Selinda	11/4/92	3:01 PM	00:16	Old
2	contract details	11/4/92	2:57 PM	00:12	Old
3	from Steve R.	11/4/92	2:51 PM	00:33	Old
4	(untitled)	11/4/92	2:45 PM	00:12	New

Mailbox 1 Default Mailbox (Greetings)

Number	Name	Date	Time	Length	Status
1	gone until 2/24	11/4/92	3:12 PM	00:12	Active Grt
2	mailbox directory	11/4/92	3:10 PM	00:05	Inactive
3	personal greeting	11/4/92	3:09 PM	00:05	Inactive
4	short greeting	10/15/92	11:45 AM	00:06	Inactive
5	business greeting	10/14/92	3:24 PM	00:29	Inactive
6	<Default Greeting>	1/1/87	12:00 PM	00:12	Inactive



	To / From	Time	Date	Status	Subject
🔒	Prometheus	01:12 PM	11/06/92	InQueue	
	Stan Diehl	01:12 PM	11/06/92	InQueue	
☎	Lisa C.'s voice mail	01:11 PM	11/05/92	Recv'd	
☎	Main mailbox	01:11 PM	11/05/92	Recv'd	
	John V.'s voice mail	01:10 PM	11/05/92	Played	
☎	Lisa C.'s voice mail	01:09 PM	11/05/92	Recv'd	
	Received Fax	01:03 PM	11/05/92	Recv'd	Rec
	Main mailbox	04:39 PM	11/04/92	Played	
	Main mailbox	04:59 PM	11/03/92	Played	
	Main mailbox	12:06 PM	11/02/92	Played	

The Complete Communicator Gold handles fax and voice messages from two separate applications. The top screen shows the Communicator's voice-mail log and a list of greetings. Home Office (bottom) manages both fax and voice-mail messages from a single window.

A data modem, a fax, and a voice-mail system are three essential components for setting up communications in a small business. Instead of requiring you to install and mediate each of these devices separately, a new group of products now pack these components onto single internal PC cards. You get complete messaging systems at a reasonable cost, but can these new fax/modem/voice cards get the job done?

To find out, I evaluated two PC messaging systems: Complete Communicator Gold, a faster version of The Complete PC's flagship product; and Home Office, a new offering from Prometheus Products (I've also seen a preproduction version of a new PC messaging system from National Semiconductor; see "A National Voice for the PC" on page 67). The idea seems to be catching on.

Common Ground

Both of the shipping products share basic design features. A single internal card holds a Hayes-compatible data modem offering industry-standard data compression (for file-compression rates of up to 4 to 1) and error correction, a 9600-bps Group 3 fax, and voice messaging. The modem on the Complete Communicator Gold ($699) runs at 9600 bps. (For $499, you can get the standard Complete Communicator with a 2400-bps modem.) The Communicator cards include a scanner port for an optional Complete PC scanner.

Home Office, equipped with a 2400-bps modem, sells for $299. Prometheus also offers a version of the product with a 14.4-Kbps modem, called Ultima Home Office, but an evaluation unit was not available at press time. Ultima Home Office costs $539 and includes the same software interface as the lower-end product.

The packages ship with fax and voice-messaging software for both DOS and Windows. A DOS communications program is also included with both products. With the Windows fax software, faxing services are available directly through a printer driver (see page 209 for a related review of Windows-based fax software).

From any Windows application, you can generate a fax job by selecting the Print option from the main menu. The driver will then load, allowing you to assign a recipient, select a cover page, and deliver the fax. Both products also include a dedicated fax application for tracking your jobs, examining incoming faxes, generating cover pages, and sending files directly. The hardware can sense the state of an incoming call—data, fax, or voice—and automatically switch to the proper receive mode. Fax and voice messaging operate in the background, so you don't have to interrupt your work to service calls.

The Home Office software keeps a single log of its transactions. From one window (see the screen) you can keep track of all your messages, both voice and fax. Clicking on a log entry plays a voice-mail message or loads a received fax to the viewer. The Communicator keeps voice messages and fax receipts in separate logs that must be accessed from different applications (the screen shows the voice-mail component). In fact, even within the voice-mail application, each mailbox keeps a unique log that must be opened separately, and when a new message comes in, you have no way of knowing where the new message ended up. The pop-up box alerting you of new messages should also tell you which mailbox the message went to. The Home Office approach, offering one-stop management of all your message traffic, is more convenient, but separate logs ensure additional privacy and security.

While the Home Office software has the advantage of simpler design, the Communicator's software proved more stable and full-featured. For instance, Home Office created TIFF files that other applications could not load. A number of applications—including Conversion Artist, Image Pals, and Picture Publisher—refused to load Home Office TIFFs. In general, the software sometimes seemed incomplete, stylistically (e.g., text was not properly aligned within a box or button) and functionally (dragging an entry from the phone book to the delivery box did not work consistently).

Take a Message

Voice messaging sets these products apart from the crowded fax/modem field. Again, both products share the same basic operation but differ in design and scope. With either product, you can set up multiple voice mailboxes and attach different greetings to each mailbox. The Communicator lets you store multiple greetings for each mailbox so that a set of customized greetings is always readily available. With Home Office, you can have only one greeting stored for each mailbox. Each time you want to change the greeting, you've got to record a new one.

Multiple mailboxes let you route calls more efficiently. Each individual in a department or small business can have a custom password-protected mailbox, available to any caller who enters the proper Touch-Tone sequence. The main greeting could then tell callers how to reach different mailboxes. Unfortunately, Home Office supports only two levels of mailboxes. After entering a Touch-Tone code to reach a secondary mailbox, the caller can't enter another code for further routing. This limits your applications. You couldn't, for instance, have callers enter a code for product information and then have them enter a second code depending on the particular product they're interested in. You can develop this type of system with the Communicator.

BYTE ACTION SUMMARY

- **WHAT PC VOICE-MESSAGING SYSTEMS ARE**
  A modem, fax, and voice-mail system on an internal PC card.

- **LIKES**
  An inexpensive way to develop a low-end fax and voice-messaging system.

- **DISLIKES**
  Only viable for a small start-up or home office.

- **RECOMMENDATIONS**
  The higher cost of the Complete Communicator Gold buys you a more stable product and a more powerful set of features.

- **PRICE**
  Complete Communicator Gold: $699 with 9600-bps modem, $499 with 2400-bps modem; Home Office: $299 with 2400-bps modem, $539 with 14.4-Kbps modem

- **FOR MORE INFORMATION**

The Complete PC
1983 Concourse Dr.
San Jose, CA 95131
(408) 434-0145
fax: (408) 434-1048
Circle 1221 on Inquiry Card.

Prometheus Products, Inc.
9524 Southwest Tualatin
Sherwood Rd.
Tualatin, OR 97062
(800) 477-3473
(503) 692-9600
fax: (503) 691-1101
Circle 1222 on Inquiry Card.

Both products also let you listen to your voice-mail messages through the telephone handset or by plugging speakers or headphones into a jack on the board. The Home Office card includes an on-board speaker, but the audio quality is too poor to be useful.

Home Office supports call screening. You can listen to an incoming message through an external speaker or headphone. If you then wish to pick up the call, Home Office automatically terminates voice mail, leaving you free to talk to the caller. The Communicator has no screening feature, but you can pick up the line even after voice mail has kicked in. And the Communicator supports Caller ID, so if you have this in your area, you can screen the phone number of the incoming caller when it appears on your computer display.

Remote Access

Like the Communicator, Home Office lets you call in from a remote phone to retrieve messages from any mailbox, and both have a valuable feature called Toll Saver. If you call in to check your messages but there are no new messages to retrieve, the system will allow an extra ring so that you can hang up and avoid a long-distance charge. With either system, you can call in remotely to retrieve messages from any mailbox, as well as delete old messages from the system. But the Communicator goes much further. Using Touch-Tone codes, you can perform almost any function available from the Windows interface: selecting and recording greetings, changing passwords, and even reconfiguring the system.

The Communicator has a clearly superior feature set. You can forward a received message to another phone or create your own messages for the Communicator to deliver. For example, you could record a voice reminder of an upcoming meeting and then automatically send the message to a group of recipients. The Communicator will then dial up each recipient and play the recorded message. You can also rename the messages in your log, assigning meaningful names—such as the name of the caller—to keep better track of your messages. And the Communicator can call you at another location (or call your beeper) when new messages arrive on the system.

Viable Voice Mail?

Integrating a modem, fax, and voice mail on a single adapter board sure seems like a good idea. It delivers vital communications services at an affordable price. But there are some drawbacks. Voice messages require plenty of disk space—200 KB for each minute of recorded voice. The Home Office helps some by giving you the option of recording at lower sampling rates, thereby saving disk space but degrading the audio quality. You will still need a hefty hard drive to hold a reasonable volume of voice mail. Memory resources are also taxed: The Home Office TSR program consumes just under 100 KB while the Communicator eats up about 144 KB.

Both products lack multiline support. As your business starts growing, your customers may hear a busy tone one too many times. These systems also need more programmability. In particular, the Home Office limit of only two levels of mailboxes is not sufficient when you're trying to create a customized voice-mail system. Deeper levels of mailboxes is a good start, but programmable firmware is what's needed. The preproduction TyIN 2000 card from National Semiconductor features a programmable processor. The BIOS code is downloaded into DRAM on boot-up, not held in a permanent ROM. This not only allows future upgrades (such as color fax or more advanced error correction) to be delivered via software disks, but it also enables you to customize the system with your own software code.

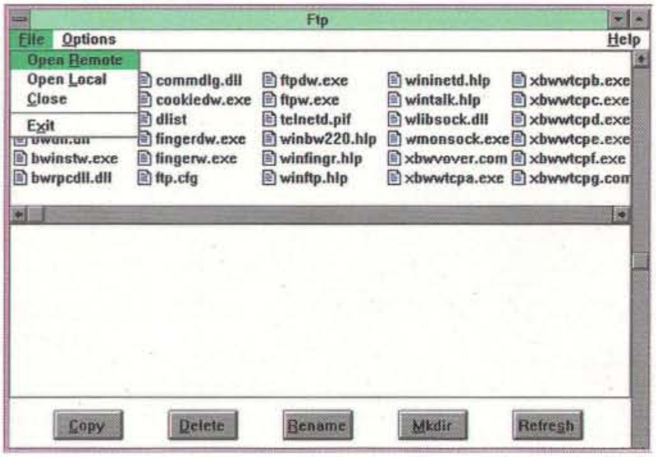
The limitations of these products are, for the most part, restrictions of scale. If your business is big enough to have its own PBX, these products will not do the job for you. They seem best suited to small start-ups and home offices that want to minimize equipment costs. For those businesses, the Complete Communicator Gold offers an impressive set of features and stable operation. Support for multiple mailbox levels is especially notable. Home Office carries a lower price tag, but the software isn't mature enough to recommend. There are some interesting developments to keep an eye on, but in the current market, the Communicator is still the one to beat. ■

Stanford Diehl is a BYTE Lab technical editor covering graphics software, peripherals, and add-ins. He can be reached on BIX as "sdiehl."

SOFTWARE

Stacking Up TCP/IP for Windows

BARRY NANCE



Screen 1: *BW-NFS includes an* `ftp` *console with a graphical, click-and-drag interface for moving files between file systems.*

Windows and Unix don't seem like a natural match, but the popularity of Windows as a client platform and Unix as a host makes finding ways to connect the two a common problem. DOS users have long enjoyed access to Unix services through products such as FTP Software's PC/TCP, but similar access through Windows (and with the Windows user interface) has been more difficult to come by.

I evaluated four products from three companies that bridge the gap between Windows and a TCP/IP environment. These four packages contain a Windows-compatible TCP/IP protocol stack, a client NFS (Network File System) component, and a collection of TCP/IP utilities. TCP/IP utilities allow Windows users to send and receive Unix mail, gain terminal access across a TCP/IP link, transfer files, run programs on another host, and join Unix print queues. NFS allows you to mount remote Unix file systems as networked PC disk drives.

The four products that I'll look at are BW-NFS 3.0 from Beame & Whiteside Software, Super-TCP for Windows version 2.00 and its companion Super-NFS Client 2.00 from Frontier Technologies, and ChameleonNFS 3.05 from NetManage. Each of these products provides at least `ftp`, `ping`, and `telnet`, and all of them provide a few other TCP/IP utilities. None, however, offers remote-shell functions (e.g., `rexec` and `rsh`) in a Windows interface.

I used SCO Unix 4.0 running on an IBM PS/2 Model 80 as the host. On the client side, I used my Compudyne 4DX/33 notebook running DOS 5.0 and Windows 3.1. A Xircom pocket Token Ring adapter and its NDIS drivers provided access to the host through my token-ring LAN.

All the products installed easily, except for one minor protection-key problem with Super-TCP. BW-NFS isn't copy-protected, and ChameleonNFS intelligently uses TCP/IP messages to detect multiple copies of itself running on the LAN.

Why Windows?

Using Windows instead of a plain DOS interface to access the Unix host has several advantages. TCP/IP utilities such as `ftp` (which uses FTP to transfer files between the local PC and a remote host or between two remote hosts) get a friendlier interface. Operations that usually require command-line entries happen under Windows in response to push buttons, check boxes, and selections from listboxes.

ChameleonNFS and Super-TCP offer a memory-saving advantage. The TCP/IP protocol stack is in a Windows DLL instead of TSR programs and device drivers. You don't have to allocate precious base DOS memory to the protocol stack.

Unfortunately, the downside of the DLL approach is that you can't access the Unix host from DOS programs. To avoid this problem, Frontier Technologies packages a TSR protocol stack with Super-TCP that you can use as an alternative to the DLL. Beame & Whiteside doesn't offer a TCP/IP DLL; it supplies only a protocol stack in the form of TSRs and device drivers.

Another advantage of a Windows TCP/IP implementation is, of course, multitasking. Multitasking allows you to more closely simulate a Unix environment, because you can run host processes that give other users access to your system while you use it for other purposes. You couldn't make this work under DOS.

BW-NFS

You can set up BW-NFS to run on any network adapter that comes with NDIS or ODI (Open Data-link Interface) drivers. You can also use it with the Crynwr (formerly Clarkson) Packet Drivers or through a serial interface (using SLIP [Serial-Line IP]).

The TCP/IP-resident portion of the BW-NFS product took 31 KB in an NDIS, token-ring configuration (in addition to the NDIS drivers themselves). I was able to load all the resident software into upper memory with DOS 5.0, but 386Max could not load TCPIP.SYS high.

continued

BYTE ACTION SUMMARY

- **WHAT TCP/IP STACKS FOR WINDOWS ARE**
  A TCP/IP stack and Windows-based Unix utilities for accessing Unix hosts from PCs running Microsoft Windows. They provide an NFS component for connecting to remote file systems.

- **LIKES**
  ChameleonNFS's unique features, most notably its NFS host facility. It also has the best Windows interface to its utilities.

- **DISLIKES**
  Documentation for Super-TCP for Windows; lack of remote-shell functions in any package.

- **RECOMMENDATIONS**
  Get ChameleonNFS.

- **PRICE**
  (Single user)
  BW-NFS 3.0, $349
  Super-TCP for Windows 2.00, $395
  Super-NFS Client 2.00, $90
  ChameleonNFS 3.05, $495

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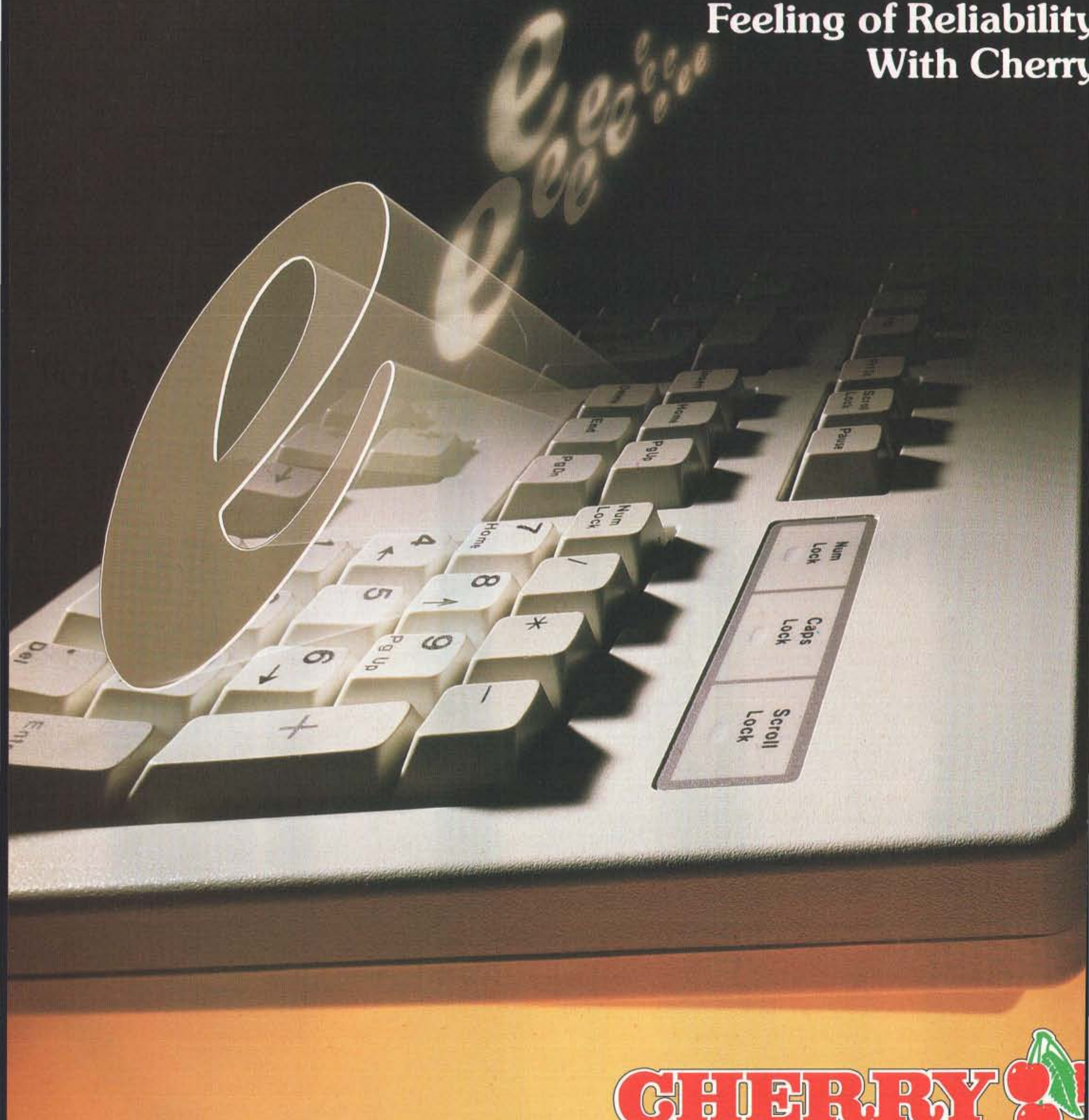

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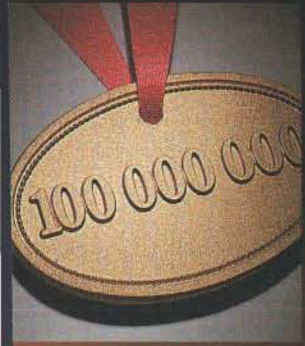


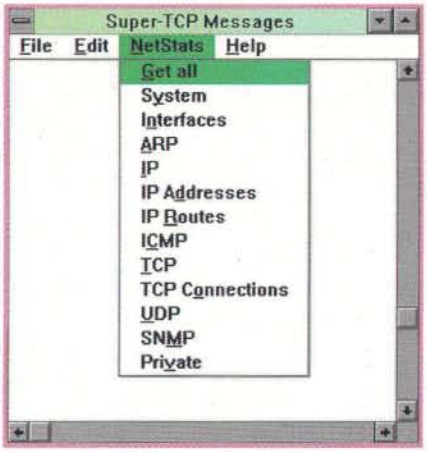
ng life: 100 million operations per key.

h quality full-travel sealed-contact system with
hanical keymodules.

t Vfg. 1046/1984
E 0871, Klasse B)

CISPR 22
EN 550 22

FCC Part 15
Subpart J
Class B



Screen 2: *Super-TCP provides useful network statistics, including IP addresses, IP routes, and ARP information.*

BW-NFS includes the standard utilities, `bw220w` (a Telnet VT-220 and 3270 terminal emulator), `finger`, and `talk`. The `bw220w` utility is a Windows version of the DOS character-mode-interface terminal program from Beame & Whiteside. In contrast, the `ftp` utility supports drag-and-drop direct manipulations with the mouse (see screen 1). You can, for example, copy a host file to your local hard drive by dragging a file icon from one window to another.

I wasn't able to send or receive mail with the BW-NFS software because Beame & Whiteside hadn't finished developing the mail software yet. When it's completed, you'll need to send in your product registration card to obtain the E-mail component.

You can mount or unmount NFS drives in File Manager's Connect Network Device dialog box, or you can issue a command-line `mount` command before you start Windows. A Windows background program, `inetd`, services requests made to your computer by other network users. You can configure the services to which `inetd` should respond (options include `ftp`, `telnet`, `finger`, and `lp`). For each authorized request that `inetd` receives, `inetd` spawns a server task on your computer.

You use the Windows-based `admin` utility for maintaining the Beame & Whiteside Telnet and FTP password files that allow or deny other users access to your PC. The `inetd` program provides almost the capability of ChameleonNFS's NFS server function.

However, `inetd` doesn't quite deliver the peer-to-peer capabilities of ChameleonNFS. Clients of the `inetd` system can only see remote files; they can't mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it's complete, accurate, and easy to follow.

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, `talk`, and `smtp`. You also get a network printing utility and an SNMP agent.

Super-TCP's `ftp` displays side-by-side local and remote host listboxes containing filenames. One push button transfers files to your PC; a second push button transfers files to the host. Super-TCP also provides network statistics, as shown in screen 2.

The separate Super-NFS Client product allows you to mount the Unix host's file systems from your PC. You can mount NFS drives from DOS or Windows; Frontier Technologies recommends that you use File Manager to do the mounting. Remote mounts aren't quite automatic; Super-NFS doesn't support the Browse option in the Connect Network Drive dialog box, and you must remember to unmount your network drives while still in Windows or Windows will crash on exit. The TCP/IP DLL doesn't support domain name resolution.

You can configure Super-TCP as a TSR or a DLL. The TSR component took 56 KB of RAM in the NDIS token-ring environment that I have. The DLL version takes up no pre-Windows DOS memory. Super-TCP works with network adapters that come with NDIS drivers or packet drivers, and Super-TCP offers SLIP access.

The reference manual is adequate but not as useful as that of the NetManage or Beame & Whiteside products. I was surprised that the printed documentation didn't warn me, for example, about Super-TCP's copy-protection scheme. Since protection keys weren't mentioned in the manual and were only listed in a readme file, I had some trouble installing Super-TCP. Once the security and documentation problems were ironed out, however, it worked fine.

ChameleonNFS

NetManage includes a unique and very useful feature in ChameleonNFS—the ability to configure your PC as an NFS server. This means that you can share files and printers PC-to-PC, without having to connect a Unix host to the LAN. You

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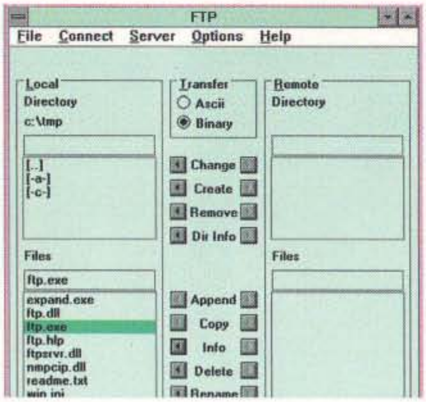

Local Directory
c:\tmp

○ Ascii
● Binary

Files
ftp.exe

Screen 3: *Like the* `ftp` *screen presented here, many utilities in ChameleonNFS are surprisingly easy to use.*

might use this feature to set up a kind of Unix-oriented peer network. The NFS server function worked well; I was even able to mount and access a PC's drive from a Unix client.

ChameleonNFS offers `telnet` (3270, ANSI, VT-52, VT-100, and VT-220 terminal emulation) and `mail` (SMTP and POP), in addition to the common utilities. ChameleonNFS also gives you `bind` (which provides Domain Name Server functions) and an SNMP agent.

NetManage's NFS implementation is the strongest of the three packages. In addition to the Windows-hosted NFS server capability, ChameleonNFS supports the mounting or unmounting of network drives from within File Manager's Network Connections dialog box. When you click on the Browse button, ChameleonNFS shows you the available (exported) remote host names and directories. You click on the host name and directory to mount, enter the DOS drive letter by which you want to refer to the host's drive, and click on Connect to complete the mounting and drive-letter mapping.

If you forget to unmount a drive before you exit Windows, Windows will sometimes crash (but not always). When you do have a problem, you'll find ChameleonNFS's help files the most complete and understandable of the lot.

The ChameleonNFS utilities are well designed and make good use of both Windows and NFS. You get easy-to-use listbox and push-button access to local and remote files, and the `ftp` utility supports a variety of host file-system types—for example, Unix, SunOS, and others—for filenames and other directory information (see screen 3).

ChameleonNFS works only with NDIS, although it offers SLIP access through a modem. Memory-wise, ChameleonNFS uses 6 KB of RAM for the base network driver. The rest of its functionality is in a Windows DLL.

You can use ChameleonNFS with NetWare if you also buy the separate IPX/Link product from NetManage. This lets you switch between ChameleonNFS and NetWare dynamically, without leaving Windows, with the MultiLAN driver.

Top TCP

I really liked NetManage's ChameleonNFS. The Windows utilities are easy to use, unique features like NFS host capability are extremely powerful, and I didn't even mind NetManage's approach to license-violation detection. The product is very well done.

BW-NFS is a close second, and worth a look if you are extremely price-sensitive. It's complete (I assume that the `mail` product will be forthcoming) and well documented. ■

Barry Nance, a programmer for the past 20 years, resides in Wethersfield, Connecticut. He is a BYTE contributing editor and the author of Using OS/2 2.0 *(Que, 1992),* Network Programming in C *(Que, 1990), and* Introduction to Networking *(Que, 1992). He is the Exchange Editor for the IBM Exchange on BIX, where you can reach him as "barryn."*

COMPANY INFORMATION

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(BW-NFS 3.0)
P.O. Box 8130
Dundas, Ontario,
Canada L9H 5E7
(416) 765-0822
fax: (416) 765-0815
Circle 1223 on Inquiry Card.

Frontier Technologies Corp.
(Super-TCP for Windows 2.00 and Super-NFS Client 2.00)
10201 North Port Washington Rd.
Mequon, WI 53092
(414) 241-4555
fax: (414) 241-7084
Circle 1224 on Inquiry Card.

NetManage, Inc.
(ChameleonNFS 3.05)
20823 Stevens Creek Blvd.
Cupertino, CA 95014
(408) 973-7171
fax: (408) 257-6405
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APPLICATIONS

Correspondence That Looks Good Globally

BIRRELL WALSH

In a global market, conducting business often involves corresponding in a variety of languages. But how do you write a letter in Urdu or draft a contract in Armenian? Gamma Productions addresses these needs with Multi-Lingual Scholar, a DOS-based word processor with fonts for 63 languages and a variety of alphabets.

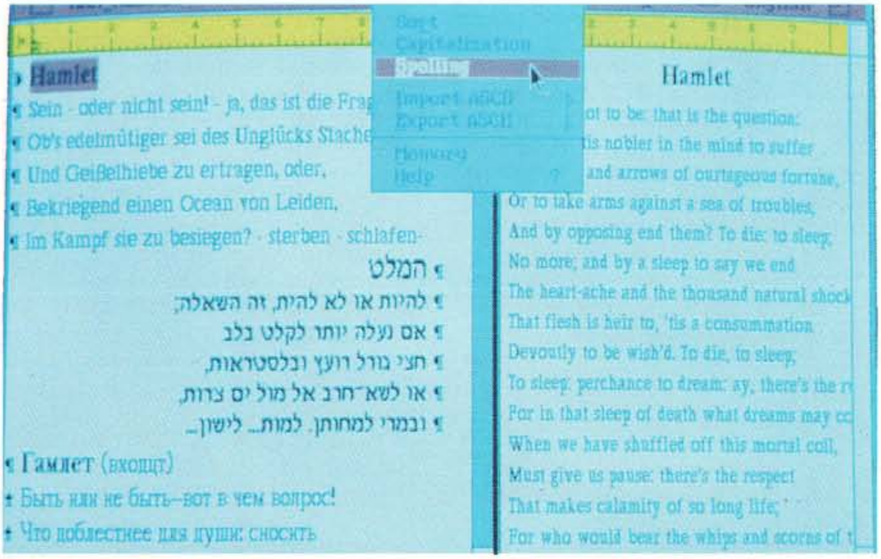
MLS doesn't translate languages; you need to know the languages or have a script. But it does provide tools for composing, importing and exporting text, creating and customizing fonts, formatting, and configuring printer fonts in almost any horizontally written script.

The benefits to using the program are documents that are correctly formatted in different alphabets, with sophisticated fonts, and free of penciled-in diacritical marks. I first learned about MLS when I needed to include passages of Greek, Hebrew, and Sanskrit in the same document. I was able to switch smoothly between languages with a few keystrokes. Each character set is so well implemented it was as if I were working in a dedicated word processor for that language. To my knowledge, it is the only program available for writing in many rare tongues.

The price you pay is that you must negotiate a nonstandard graphical interface. You must learn the program's way of implementing style sheets. You must also master the setup process if you want to use an unusual configuration.

Who can benefit most from MLS? Primarily business, government, and academia. Most of the languages MLS provides are modern, like Thai and Hindi, but it offers some ancient ones like Syriac (although a typical businessperson won't usually need to write in an ancient language). If you have on staff a person literate in those languages, you'll be able to produce good-looking business documents in MLS.

If you are doing business with a foreign country, you'll need to work with governments, and some governments might also be using MLS. The Canadian government, for example, bought the program to write in Inuktitut, an Eskimo language with its own alphabet. Voice of America uses MLS for its field correspondents, and the BBC uses it in London for its foreign-language journalists.



Hamlet

Sein - oder nicht sein! - ja, das ist die Frag
Ob's edelmütiger sei des Unglücks Stache
Und Geißelhiebe zu ertragen, oder,
Bekriegend einen Ocean von Leiden,
Im Kampf sie zu besiegen? - sterben - schlafen-

המלט
להיות או לא להית, זה השאלה;
אם נעלה יותר לקלט בלב
חצי גורל רועץ ובלסטראות,
או לשא־חרב אל מול ים צרות,
ובמרי למחותן. למות... לישון...

Гамлет (входит)
Быть или не быть—вот в чем вопрос!
Что доблестнее для души: сносить

Hamlet

ot to be: that is the question:
'tis nobler in the mind to suffer
and arrows of outrageous fortune,
Or to take arms against a sea of troubles,
And by opposing end them? To die: to sleep;
No more; and by a sleep to say we end
The heart-ache and the thousand natural shock
That flesh is heir to, 'tis a consummation
Devoutly to be wish'd. To die, to sleep;
To sleep: perchance to dream: ay, there's the r
For in that sleep of death what dreams may co
When we have shuffled off this mortal coil,
Must give us pause: there's the respect
That makes calamity of so long life;
For who would bear the whips and scorns of t

Multi-Lingual Scholar has fonts and formats for 63 languages and many alphabets.

Alphabets from A to Z

In addition to the English alphabet, the basic package includes the Arabic/Persian, Greek, Cyrillic, and Hebrew alphabets. With these, and by purchasing additional fonts (beginning at $50) from Gamma Productions, you can write in more than 60 languages, including Arabic, Croatian, the International Phonetic Alphabet, Russian, Thai, Urdu, and Yiddish. All the fonts I have seen are handsome when laser-printed and are suitable for camera-ready copy.

When you first start a document, the languages available are listed in the style menu. When you are writing in English, MLS functions like a traditional word processor. When you switch to another language, the program loads a new screen font and a new keyboard map. Style sheets can include language choice as well as formatting commands, so you can load a new language, style, and font with three keystrokes. When you print your document, MLS downloads the fonts. I find it easy to work in two or three languages in one document. The only problem is learning where the keys for characters are located.

Almost every language in the Latin alphabet includes unique characters, accents, or diacritical marks not found in most American-born word processors. MLS has them all, in addition to its non-Latin alphabets. Third-party foreign language fonts designed for Windows or for WordPerfect and other word processors may be fine for writing in one language at a time, but if you need to switch back and forth between languages, MLS handles the details beautifully.

You can have up to 10 working languages in one document and 16 fonts per page. When you switch between languages, all the rules switch as well. For example, if you embed Hebrew in an English document, MLS knows the Hebrew text is written from right to left. If the Hebrew is contained within an English paragraph, the Hebrew flows from right to left but the rest of the text remains aligned to the left. You can also override the automatic formatting.

In many languages, the placement of vowels and accents varies depending on surrounding consonants. Placement in reference to the baseline varies as well. In Hebrew, Arabic, and Hindi/Sanskrit, vowels may occur above, below, after, and even before consonants they follow in speech. MLS treats these vowels as overstrikes assigned to function keys or as specific character pairs assigned to one key.

MLS manages other features that have no equivalent in European languages. For instance, in Arabic and Hebrew, some letters have different forms depending on whether they're initial, final, stand-alone, or embedded. MLS checks for the position of the letter and chooses the appropriate character form. MLS also handles "kashideh" justification. Whereas most

Western languages justify text by adding space between letters and words, Arabic and some North Indian alphabets justify with extended lines within words. Exemplifying this technique are the long loops of Arabic or the overhead lines from which Indian languages hang their characters.

Convert and Customize

The base package of MLS comes with a number of keyboard maps for Latin-alphabet languages, including American, British, German, French, Spanish, and Italian. Cyrillic, Hebrew, Greek, and Arabic come with standard national typewriter layouts as well as layouts mapping English letters to close phonetic equivalents. You get two extra font disks of your choice with the package, and another one free when you send in your completed tutorial.

I tested MLS on a 33-MHz 386 system with 4 MB of RAM. Part of the process included editing blocks of several languages, often within one paragraph, including fifth-century B.C. Sanskrit and Hebrew, and Greek from a thousand years later. The program maintained correct formatting for each language. Then I printed the blocks on a Hewlett-Packard LaserJet II, which produced accurate results. Texts were also exported from MLS as PCX files. You can export the image files into Microsoft Windows Paint and further enhance them, as I did to make large signs.

BYTE ACTION SUMMARY

- **WHAT MULTI-LINGUAL SCHOLAR 4.01 IS**
  A DOS word processor with support for 63 languages, up to 10 at once.
- **LIKES**
  MLS handles the complexities of many languages and switches between languages easily.
- **DISLIKES**
  This version does not support vertically written languages or embedded graphics; no Japanese or Chinese.
- **RECOMMENDATIONS**
  MLS is an excellent choice if you need to work in any of the languages supported. For some rare languages, it is the only choice.
- **PRICE**
  $695 (Roman, Arabic, Hebrew, Greek, and Cyrillic alphabets are included; additional fonts, $50 and up.)
- **FOR MORE INFORMATION**

Gamma Productions, Inc.
710 Wilshire Blvd., Suite 609
Santa Monica, CA 90401
(310) 394-8622
fax: (310) 395-4214
Circle 1234 on Inquiry Card.

Flexible Design

MLS helps you convert any language or script into any other. For instance, you can use texts that have been created by the University of Pennsylvania's Center for Computer Analysis of Texts, even though their formats differ from those of MLS files. Let's say you want to import portions of a CCAT Greek New Testament text. You'll need to use the Configurable Text Interchange Utility that Gamma Productions bundles with MLS. You can configure CTIU to convert any text string to any other text string. You can also employ it to design any conversion—including formatting codes—that can be coded into 8-bit bytes.

Every feature of MLS is designed to be redesigned. You can customize the fonts, rules, and formatting to almost any degree you wish. If Gamma doesn't sell the language you want, you can build a font for it with Font Scholar, a program for creating fonts that's also included with MLS.

To build a font, you can either use Font Scholar's graphics tools or scan in an alphabet and attach characters to keys with a keyboard map. Either way, it takes time to build a font. You can also define the rules governing the language: text flow from right to left or left to right, contextual character forms, type of microjustification, and import/export conversion codes.

Almost WYSIWYG, Almost Universal

If all these features seem too wonderful to be true, be aware that there are some shortcomings to the current version of MLS. One is the inability to write in either Chinese or Japanese. Both languages are often written vertically, and both use thousands of ideographs rather than a phonetic alphabet. The myriad characters cannot be encoded adequately in the 256 possibilities of an 8-bit byte (see "In the Land of the Double Byte," October 1992 BYTE).

Another drawback is that the MLS interface is poised about midway between early-1980s word processors and today's desktop publishing packages. What you see is *almost* what you get. Columns do not appear on the screen, but typefaces and styles are shown. Also, MLS's interface is an island unto itself in a world that is increasingly standardizing on Windows. However, MLS lets you create style sheets that include language choice as well as font, type attribute, justification, line spacing, and indentation.

The program gives so much that you want it to give more. Many of the languages are found nowhere else; in these cases, you would need to use MLS as a desktop publisher, perhaps to publish a catalog in five Indian languages to reach the subcontinent's huge market. But in this version, you would have to paste graphics in by hand.

Fortunately, Gamma Productions is working on a Windows version, to be called UniVerse, scheduled for release early this year. The Windows version will support embedded graphics and vertically written languages. Gamma Productions is also promising to support Unicode. Unicode is a proposed 2-byte standard; 65,536 possibilities will allow encoding of *all* the major world languages, including Chinese and Japanese. With Unicode compliance, the infrastructure to build character sets for Chinese and Japanese will be in place, but Gamma Productions is not expecting to release these character sets before late 1993, when a scalable font of many thousand Japanese characters may be ready for publication.

Gamma Productions is also shifting its focus from bit-mapped to scalable fonts. Current bit-mapped fonts will continue to work, but so will TrueType and Adobe Type 1 fonts. Font Scholar, which produces only bit-mapped fonts, may no longer be bundled with MLS. The company is also devising a licensing system for developing Unicode-compliant software (before Unicode compliance becomes universal in Windows NT). A Macintosh version is also in the works for late 1993.

Multi-Lingual Scholar 4.01 for DOS is a very good word processor if you need to work in one or more of the supported alphabets. Scholars and businesspeople will have no trouble creating multilanguage documents. If you need to develop your own font for a language not usually supported by word processors, MLS is an extraordinary bargain. ■

Birrell Walsh is a contributing editor for MicroTimes Magazine *and a doctoral student in religion and philosophy at the California Institute of Integral Studies, where he works in Sanskrit, Hebrew, and Greek. He can be reached on CompuServe at 72466,3567 or on the Internet at birrell.well.@sf.ca.us.*

Retooling a Classic

TOM THOMPSON

Introducing the BYTE Lab's updated Macintosh Benchmarks

This issue introduces version 2.0 of the BYTE Lab's low-level Macintosh benchmarks (see "New Tricks for Slow Macs" on page 198). The Macintosh low-levels, like their DOS counterparts, evaluate video, disk I/O, CPU processing speed, and floating-point performance. The benchmarks consist of a suite of small applications, each of which exercises a particular subsystem. For example, to measure the Quadra 950's disk I/O performance, we launch the Disk I/O application and wait while the code automatically times itself creating and writing files. When the test ends, we log the result and launch the next test application.

Our first Macintosh benchmarks—the first by a computer magazine testing lab—were written in July 1988; we used them to evaluate the Mac IIx. It's a tribute to good software design that the benchmarks survived several major revisions of the Mac OS and were used to measure the subsystems of the Mac IIvx, PowerBook Duo 230, and PowerBook 180.

Having said that, I also have to admit that we had to log test results by hand. Problems cropped up when Apple began introducing new computers in batches. Benchmarking one or two new Macs was easy, but testing five or six Macs at once and manually logging the results was an endurance test. I still remember a marathon session at Apple lasting over 4 hours during which Bruce Gee, the PowerBook product manager, helped me run the low-level tests on the then-new Mac PowerBooks, Quadras, and Classic II. Thus, out of necessity, the new tests were born.

The applications were originally created using a Small-C cross compiler written at BYTE that ran on a PC. We'd write Small-C code on the PC, and it would generate a file of 68000 assembly language instructions. This file would be copied to the Mac and assembled into a stand-alone application using Consulair's Macintosh Development System assembler. We chose Small-C as the code generator because it avoided a controversy raging at the time regarding how various compilers optimized benchmark code. Because Small-C didn't, it made the issue moot. To use Mac Toolbox traps, we wrote in-line assembly language glue code, since Small-C—written for CP/M by Jim Hendrix—had no idea what a Mac was, much less how to create calls for the Mac OS.

We then set our sights on producing the latest version of our Macintosh benchmarks. Since the old test code was still proving its worth (it detected the floating-point performance boost of Omega SANE in System 7.0.1 and also detected that the Mac IIvx used a 16-MHz bus), we planned to reuse as much existing code as possible. The real design priorities became to produce crash-free code and make the tests easier to run. Dealing with these demands meant abandoning the Small-C cross compiler. First, it was out of date, and second, putting a friendly interface on the benchmarks required using lots of Toolbox calls.

I chose Think C for the job because it's small and fast as Mac development tools go, it provides comprehensive Toolbox access, and it supports the use of in-line assembly language. This let me port the existing benchmark code with its mix of C and assembly language instructions. I also had a proven application code skeleton written in Think C.

Of course, the job wasn't as simple as it sounds. There were the usual headaches revising the Small-C code, which used ancient header files, to conform with Think C's header files. The assembly language sections—especially the SANE macros for the floating-point benchmark—required some work too. Missing a small detail here caused all sorts of crashes. To get the first benchmark to operate, I had to go into hack mode and walk through the code instruction by instruction in a low-level debugger while watching the registers and stack to isolate the problem. Jasik Design's The Debugger was handy when I rooted out trouble at this level. Once I had discovered that Small-C passed function arguments on the stack the reverse from the way Think C did, it took little time to get the first benchmark—quickly followed by the others—in operation.

The final design of the new benchmarks is that of a single application that runs and times the tests. You can run all the benchmarks (the default), a suite of tests (e.g., the video I/O), or a mix of tests. Results are displayed in a window, or you can save them as a log file on disk. Because most tests dropped into assembly language code, many of the times are close to the version 1.0 times. The exceptions are the Sort, Sieve, and TextEdit, whose results changed because they were written entirely in C.

Now, testing a Mac just requires that you launch one application, make a menu selection, and let the program do the rest. Will these benchmarks hold up as long as the originals? Perhaps. But with Apple releasing more and more Macs, and the PowerPC coming down the pike, I expect I might have to work on them again in the near future. ■

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BOOK
AND CD-ROM REVIEWS

AGAIN THE SWINGING GATES

Gates, *Stephen Manes and Paul Andrews*, Doubleday, $25, ISBN 0-385-42075-7

HUGH KENNER

Only last July, this space was shared between *Hard Drive*, all about Bill Gates, and *Accidental Empires*, in which Gates's Microsoft, IBM, and Gates himself ranked 1, 2, 3 in length of index entries. So why another Gates book so soon? Chiefly because it gets us past the *Hard Drive* fixation on temper tantrums and dandruff. If Bill Gates merits more than tabloid attention, it's because he helped reinvent the desktop computer industry, a feat that Manes and Andrews understand as their *Hard Drive* precursors never quite did.

ROM and RAM, bit and byte, DOS in numerous flavors or GUI, interpreted BASIC or compiled—the current that gives meaning to Chairman Bill's life has streamed past and around such markers. From about the middle of their long book, Manes and Andrews help us sense the force and purpose of that current, as it drives interactions with IBM, with Apple, with a calculated future.

Knowing what jargon words mean, they've been able to talk profitably with more than 300 sources. That's something you can do only if your source senses there's a language in common; otherwise, you'll pick up just what it's easiest for the source to brush you off with—namely, gossip. About half the informants "gave us hours of their time—a full workday in more than one case." The rest granted access by phone for up to an entire evening. All that solid information does show.

Something else, and our authors well know how this can be tricky: Bill Gates himself granted interviews, hours of them. As one of their contacts asks, "Is this an authorized biography or an honest one?" An afterword, some 3000 words called "Full Disclosure," addresses that topic in such detail that we soon find that we're being told who paid for which lunch.

Briefly: Early in 1991, the authors called Microsoft PR and got rebuffed. Three months later, a Seattle paper (not the one Paul Andrews writes for) launched a series on Gates by the authors of what would later be *Hard Drive*, and Microsoft called Manes and Andrews back, apparently spotting a potential corrective. Manes and Andrews stipulated independence—neither Gates nor Microsoft would have the right to read the manuscript—and got 11 interviews totaling 20 hours.

But then, as the book was going into production, apparently someone who'd been sent a typescript to base a blurb on passed the evidence to Chairman Bill, who accessed one of his famous tantrums and demanded a meeting. "We could have said no; but since he had already read the manuscript, it seemed unreasonable to turn down the free services of the best-paid fact-checker in the known universe." Hence 2 hours face-to-face, 7 hours more by phone.

(A recurrent theme in the book: What you do about Bill's screaming fits is stand up to them. He ends up subsiding into exhausted respect.)

And the upshot: dozens of rechecks, corrections of a few "horrible errors," and some "minor gaffes"; but "the vast majority of other items" let stand. I'd not summarize that story in such detail did it not make starkly plain the suspicious and litigious climate in which elucidation must send forth its shoots. Not the least suspicious party is apt to be someone like you or me, wondering about bribes and PR.

Anyone interested in the multimillion-dollar phenomenon called Windows, and why it was years getting shaped into anything usable, and what were the details, meanwhile, of Microsoft's frenzied interactions with Apple and IBM, need look no further than this book. If we're stuck with Windows, seemingly, the way we're stuck with the QWERTY keyboard, how that came about still makes an engrossing narrative. ■

Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. His recent books include Mazes *and* Historical Fictions. *You can contact him on BIX as "hkenner."*

THE INFINITELY SMALL

Nanosystems: Molecular Machinery, Manufacturing, and Computation,
K. Eric Drexler, Wiley-Interscience, $24.95, ISBN 0-471-57518-6.

Imagine a world of manufactured devices so small that the designer must specify the order and arrangement of atoms in the finished machines. Consider systems so finely tuned that their operation is performed through the making and breaking of single chemical bonds.

Creating such worlds has been the decade-long quest of K. Eric Drexler, president of the Foresight Institute. His latest work, *Nanosystems: Molecular Machinery, Manufacturing, and Computation*, is a scholarly review of the physical and chemical concepts that may one day enable the production of desktop nano molecular devices.

Drexler's book is a return to first principles—the design of levers, ratchets, gears, springs, and pistons. Except, at the nano level, we now need to be concerned about the stiffness and tensile strength between individual molecules. Once the basics are understood, you can move on to the complex machines, such as a six-legged tool positioner composed of 3 million atoms and able to move approximately 100 nanometers. My favorite chapter describes the design of basic logic gates for a mechanical computer. The book includes the design of a finite-state machine theoretically capable of reaching over 1000 MIPS.

Nanosystems is not a light romp through the world of the future. It is a scholarly examination of how this technology works, a reference book for the crafters of the future.

—Raymond GA Côté

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THE NETWORK FRIEND

CD-ROM

Support on Site for Networks, $1495,
Computer Library, 10 Park Ave.,
New York, NY 10016, (212) 503-4400.

Support on Site for Networks is a hodgepodge of books, manuals, diagrams, compatibility reports, and technical notes for LAN administrators and network troubleshooters. Its interface and search engine will be familiar to users of the popular Computer Select product. Books include the M&T troubleshooting series on LAN Manager, NetWare, and internetworks, along with Stephen Saxon's *Running Windows on NetWare*. Vendors that have provided software and hardware documentation include Banyan Systems, 3Com, Advanced Logic Research, Cabletron Systems, IBM, Microsoft, Novell, SMC, Synoptics Communications, and Thomas-Conrad. Software vendors are well represented, but coverage of NIC (network interface card), hub, and router products is quite spotty.

The disc includes nearly 3000 compatibility reports and nearly 17,000 technical notes that are the real meat of Support on Site for Networks. In how many cases would you find a solution in a relevant technical note? For BYTE's 50-node Mac/PC/Unix LAN, the answer would seem to be "not many," and I doubt that I could justify $1495 for a one-year (12 updates) subscription. If you manage hundreds or thousands of nodes, on the other hand, there's a good chance you'll want a copy of this within reach.

—Jon Udell

CONTROVERSIAL WINDOWS

Undocumented Windows, *Andrew Schulman, David Maxey, and Matt Pietrek,* Addison-Wesley, $39.95, ISBN 0-201-60834-0.

Few trade books have inspired such a swirl of controversy. When *Undocumented Windows* appeared last fall, Microsoft bashers pounced eagerly on passages that showed how Microsoft's tools and applications exploit undocumented Windows APIs and data structures. Microsoft, under FTC scrutiny for such practices, retaliated with a massive press release describing documented alternatives to these APIs and data structures. The company further claimed that its programmers gained nothing by their use of undocumented features and even, in some cases, suffered for their backdoor tricks. This perverse argument provoked Schulman to dig up more evidence—far more damning than what's actually in *Undocumented Windows*—that Microsoft's applications programmers do profit by their special knowledge of Windows internals.

This juicy scandal has undoubtedly spurred sales, but that is hardly a reason to buy the book. Read it, instead, for its remarkable insights into the architecture of Windows and the nature of Windows programming. The conventional view is that Windows is—and should be—a set of mysterious data structures wrapped in an enigmatic function-call interface. While such information hiding can be useful, there are also good reasons to know something about the real objects (e.g., window structures and device contexts) that lie behind the veil (e.g., HWNDs and HDCs).

The discovery of these secrets took a large amount of excellent detective work. Using commercial debuggers and disassemblers, along with an impressive collection of homegrown tools (included on the accompanying disk), the authors patiently strip away Windows' veneer of mystery to reveal a complex, sometimes wacky, but ultimately coherent work of software engineering. Some of the undocumented functions they unearth will be of general use to Windows programmers. For example, *IsWinOldApTask* distinguishes between DOS and Windows tasks. Other undocumented functions, like the infamous *TabTheTextOutForWimps*, are included just for completeness.

Although it's packed with dense technical detail, the book is a surprisingly good read. The rocket science is leavened with a healthy dose of humor. On WinWord's mishandling of the idle interrupt: "Where's a decent monopoly when you need one?" On event-driven programming: "Only the size of the manuals has changed…it's really just good old interrupt handling in yuppie attire." Like its predecessor *Undocumented DOS*, *Undocumented Windows* is an instant classic.

—Jon Udell

ODE TO OBERON

Programming in Oberon, *Martin Reiser and Niklaus Wirth,* Addison-Wesley, $19.95, ISBN 0-201-56543-9.

Oberon is Niklaus Wirth's latest programming language, the successor to Modula-2, which in turn succeeded Pascal. Wirth quotes another famous Swiss, Albert Einstein, in pronouncing Oberon "as simple as possible but not simpler." This book is a tutorial and language reference for Oberon and its elegant GUI operating system. The style is lucid and authoritative, and the programming examples are not the familiar 10-line clichés, but weighty topics like a discrete-event simulation and the Oberon graphics editor.

Throughout the text, Reiser and Wirth draw attention to questions of program correctness and proof, but without introducing too many unreadable formalisms. Chapter 12, "Object-Orientation," offers the best, most jargon-free overview of what OOP (object-oriented programming) really involves that I've read anywhere. It contrasts two possible OOP approaches in Oberon, using type extensions with methods implemented as either procedure variables or handlers. Wirth has mellowed his previous skepticism toward OOP and describes Oberon-2, an upwardly compatible extension that provides a true class mechanism via type-bound procedures, with a syntax not unlike Object Pascal.

Next time swatting the bugs in your C++ project gets you down, buy this book for a glimpse of a better world.

—Dick Pountain

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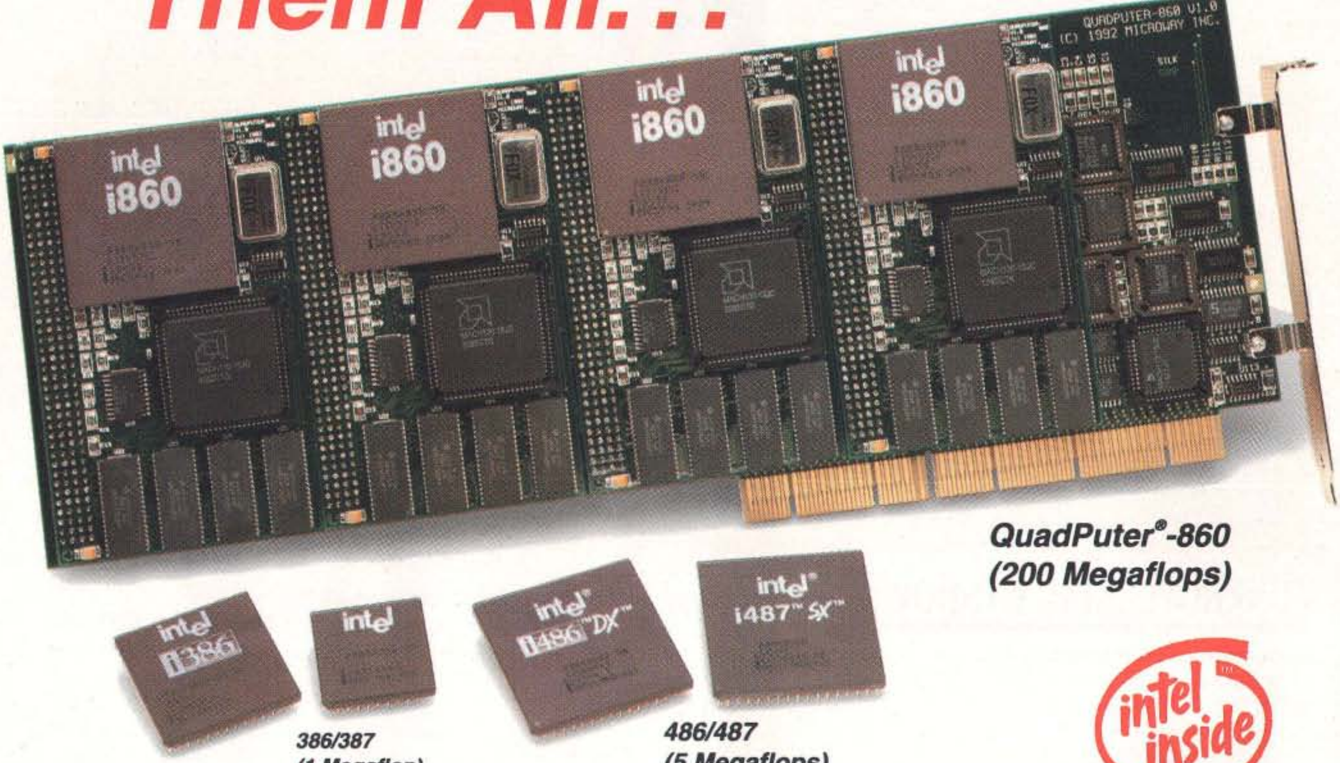

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ANDREW W. DAVIS
AND JOE BURKE

THE MAC GOES TO THE MOVIES

An inside look at Apple's QuickTime cross-platform multimedia standard

QuickTime is Apple's multimedia software standard. A hardware-independent extension to the Mac OS, QuickTime integrates time-based dynamic data types, such as sound, video, and animation, into applications as digital *movies*. As this term implies, QuickTime manages events that happen over time in much the same way that QuickDraw manages still images. Just as PICT graphics enhance presentations, QuickTime movies add a new dimension to communications, presentations, simulations, and decision-support applications.

In addition to being the foundation developers use for creating multimedia applications on the Mac, QuickTime gives users a standard way to display, compress, copy, and paste time-based data. QuickTime follows Apple's philosophy that such data should be incorporated as a standard data type and you shouldn't have to be a multimedia professional to create multimedia documents. QuickTime is hardware independent, which allows for the development of QuickTime software for non-Mac computers. Apple began shipping a version of QuickTime for Microsoft Windows as this article went to press.

The QuickTime Architecture

QuickTime consists of four major components: system software, file formats, Apple compressors/decompressors (called codecs), and human-interface standards and utilities (see figure 1). The system software has three subcomponents: the Movie Toolbox, for the creating, editing, and playback of movies; the Image Compression Manager, or ICM; and the Component Manager. We'll discuss these three components in detail later.

A *movie* is a container for all types of dynamic data. It can be used for such things as a presentation slide show, an animated bar chart, a montage of images and sounds, or a dynamic graph of laboratory data. Movies contain references to groups of homogeneous data, such as video or sound, that are organized into *tracks* (see figure 2). Tracks don't contain the data, but instead reference actual data files on videotape, disk, and other media. QuickTime synchronizes these tracks when it plays a movie.

The movie file format emulates big-screen movies by including provisions for *posters* (i.e., still frames that represent the movie for printing) and *previews* (i.e., short clips that represent the movie when previewing). Because a movie file contains references to only its media data, it's small enough to put onto the *scrap*, which is the data container that the Mac Clipboard and Scrapbook use.

Apple has extended the PICT file format to allow for compression and previewing. Users can compress a still image using any compression scheme registered with the Component Manager and decompress a still image

ILLUSTRATION: LYN BOYER-PENNINGTON © 1993

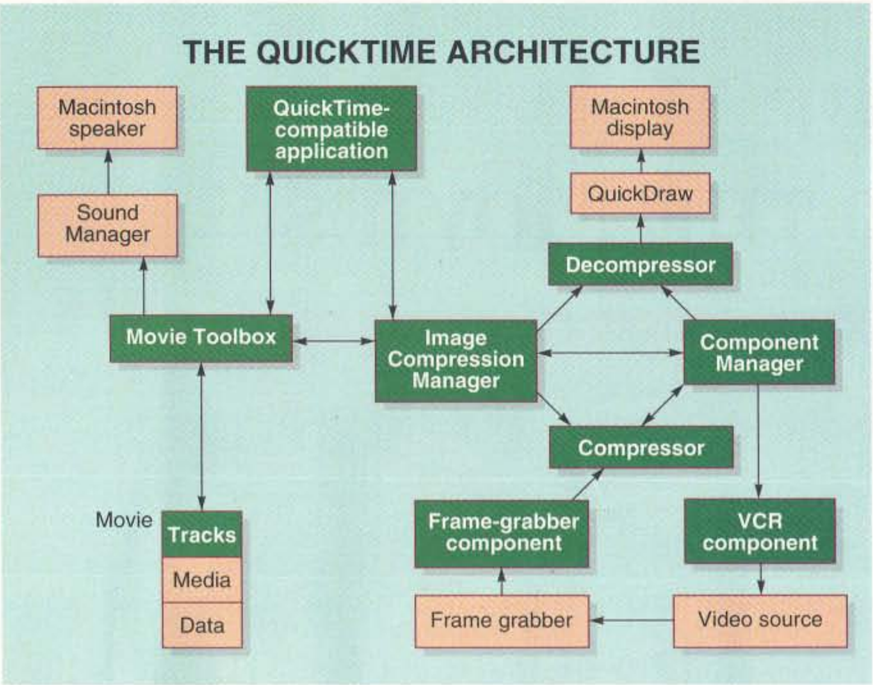

Figure 1: *QuickTime applications interact with the Image Compression Manager, which shields the application from compression details, and the Movie Toolbox, which controls access to movie data. The ICM interacts with the Component Manager, compressor, and decompressor. In this figure, QuickTime elements appear in green.*

using any existing, unmodified application as long as the QuickTime extension is installed. Using previews, applications can save a small 4- to 5-KB thumbnail image along with the actual image so that users can quickly browse through image libraries.

QuickTime provides a basic set of software compression/decompression schemes for still images, animation, and video. By standardizing the way in which programs compress images and movies, QuickTime makes it possible to move them easily between documents. This allows users to view thumbnails of images, preview a movie by snapping through images, and convert to PICT-file format on the fly. QuickTime 1.5, introduced last fall, supports Kodak's Photo CD standard. Thus, you can use Photo CD with any application that handles PICT files.

Apple specifies human-interface guidelines to provide consistency among the ways in which applications handle dynamic media. For example, the movie controller is a system software component that provides a consistent way of controlling movies: turning sound on and off, playing or stopping a movie, getting an indication of where in the movie you are, interactively moving around the movie, and cutting, copying, and pasting movie segments.

Movies, Tracks, and Media

Time is a fundamental concept in QuickTime movies. Every movie has a time scale, a time base, and a time-coordinate system. The time scale defines the unit of measure and the movie's duration. The time base is the current value of time along with a vector that defines the direction (forward or backward) and velocity of time (the current value of time is meaningless until the time scale is specified). The time-base value is extracted from the time-coordinate system, which essentially comprises the *x*, *y* axis on which the time-base vector is plotted.

Each track defines a separate set of data that can be interpreted within the movie's time-coordinate system. All tracks begin at the start of the movie, but not all of them contain data initially. Even those that do contain data won't play unless they are activated (see figure 2). QuickTime movies may have one or more tracks active simultaneously.

When you're editing a movie file, you define a segment by specifying a start time and a duration. Two elements define a movie's display characteristics: the movie source clipping region, which defines the portion of the source image that's visible, and the 3-by-3 transformation matrix, which determines how the image will be rotated and scaled. The Movie Toolbox uses these elements to determine spatial characteristics, and it provides routines that let you work with movie or track characteristics, such as the volume setting and playback rate. The Movie Toolbox also lets each application store its own user data along with a movie.

A track is a private data structure with its own control information. Each track represents a single stream of data and refers to a single medium, or file, that contains movie data. A track contains a list of references, called an *edit list*, that defines the portions of the medium used. Consequently, a track can play the media data in any order, for any number of repetitions. Each entry in the edit list includes the starting time and duration of a track segment, along with the playback rate for that segment. The actual data may reside on a CD-ROM disc, a hard disk, videotape, or other medium.

A movie can contain more than one track of a given type. This is handy if you want to create a movie with sound tracks in different languages. You manage these tracks by assigning them to alternate groups and making one active at a time.

A QuickTime track's display characteristics are specified by the image size, a transformation matrix, and a clipping region. Each track also has a volume setting for sound.

The medium contains a track's data and information that identifies its language and quality. Each storage medium has its own time scale and duration, so any time values that relate to a given medium must be defined within the medium's parameters. A medium uses the time base of the movie that is using the medium's data, and the tracks map data from the medium's time system to the movie's time system. Each supported data type has a media handler that provides random access to the data and plays segments at rates that the movie specifies.

QuickTime movie tracks do not ordinarily contain movie data, but you can use the Movie Toolbox to create movie files that store the movie and all related data in the Mac data fork. This is useful for sharing QuickTime movies with computers that support QuickTime but don't support multifork files. QuickTime support is quickly moving beyond the Mac: Apple developed a QuickTime player for Windows, and Silicon Graphics has added QuickTime support to its applications.

The Movie Toolbox

At the heart of QuickTime is the Movie Toolbox. It includes scores of high-level routines that let you load, play, create, edit, and store objects that contain time-based data.

The Movie Toolbox routines provide basic operations for opening and playing movies, as well as more complex routines for creating and manipulating the data that make up a movie's media types (i.e., sound, video, graphics, or animation). You initialize the Movie Toolbox by calling the `Entermovies` routine. Similarly, the `Exitmovies` routine cleans up after your application is finished.

Before an application can work with a movie, it must load the movie and then create a new movie file in which to work. The `OpenmovieFile` routine opens a movie file; `NewmovieFromFile` loads a movie. When you play a movie, the Movie Toolbox processes the movie's data based on its time-coordinate system. If the movie contains video data, the Movie Toolbox displays the resulting images in the display window you specify. If the movie contains audio data, the Movie Toolbox plays the sound track at a volume level that you set.

The ICM

Uncompressed image data requires a large amount of storage space. At 30 frames per second, a 10-second movie containing 640- by 480-pixel frames with 8-bit color requires nearly 100 MB of disk space. Consequently, minimizing the storage requirements (and network and backplane bandwidth requirements) for image data is an important consideration for any application that works with images or sequences of images.

QuickTime's ICM provides applications with image compression and decompression services that are device- and algorithm-independent. Two points about the ICM are worth noting: Its architecture is open and handles many different kinds of algorithms, and it can read and perform compression schemes on the fly. The ICM also manages many display details, such as clipping, scaling, crossing screens, and fast dithering. In this way, the ICM enables all QuickTime-compatible software to use a common application interface for compression and decompression operations on images and sequences of images, and it allows an application to use images created with a different application.

The ICM invokes *compressor components*, code resources managed by the Component Manager that perform actual compression services (see figure 3). Applications communicate either directly with the ICM or indirectly via the Movie Toolbox, which passes requests to the Component Manager. The ICM does not maintain time information for an image sequence—the Movie Toolbox handles all timing considerations—but it does maintain the order and content of the images.

The compression algorithm used affects the compression ratio and speed, symmetry, and image quality (e.g., loss characteristics). Different applications make different compression trade-offs. QuickTime ships with three algorithms. The photo compressor implements the JPEG (Joint Photographic Experts Group) algorithm, which QuickTime uses for PICT images. The video compressor uses an Apple-designed algorithm that permits fast decompression times while maintaining reasonably good picture quality. The video compressor allows interactive display of 24-bit images; processes input video images at 8-bit, 16-bit, and 24-bit color depths; and supports both spatial and temporal compression. The animation compressor is based on an algorithm optimized for animation and computer-generated video data.

The ICM also lets you obtain information about compressed images or about the facilities available for image compression, select a specific compressor, and determine how much memory to allocate to receive a decompressed image. You can even display a compressed PICT file without performing any special processing. When installed on a system, the ICM creates a new `StdPix GrafProc` procedure, which handles all requests to display pictures. Whenever an application issues the standard `DrawPicture` function to display a picture that contains compressed image data, the `StdPix` procedure decompresses the image by invoking the ICM and delivers the decompressed image to the application.

The ICM uses PICT op codes to store the compressed picture's image description (i.e., its compression format and characteristics of the compressed image data), image data, transfer mode (`srcCopy`, `ditherCopy`, and so on), the accuracy with which the image should be decompressed, the matte pixel map, the mask region, the mapping matrix, and the source rectangle of the image. Masks and mattes control which pixels in the source image are drawn to the destination. Mattes provide a mechanism for mixing two images. Because the ICM stores the mask and matte images separately, you can apply different masks or mattes during decompression.

A QuickTime application might give the user the option to specify a compression algorithm that's based on performance characteristics such as size, speed, and accuracy. The ICM allows the application to choose the compressor component that meets the user's criteria. Many ICM functions accept special component identifiers that select the fastest or most accurate compression algorithm or the algorithm that produces the smallest compressed image from among those that are installed on a given system.

continued

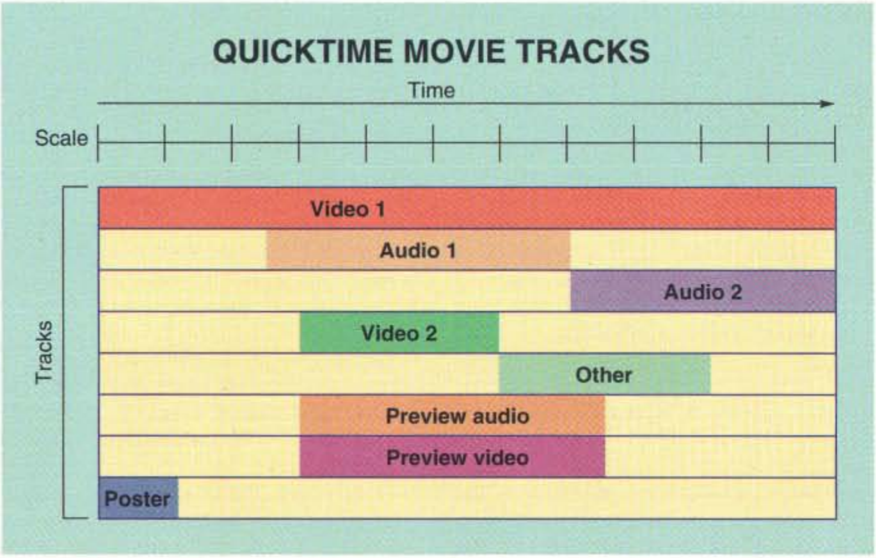

Figure 2: *A QuickTime movie consists of multiple tracks that reference different data types on various media. Shown are five movie tracks, plus two preview tracks and a poster track. All tracks begin at the start of the movie, although the data does not always start at the beginning of a track. A track can end at any time, and QuickTime plays only those tracks that are active. Multiple tracks can be active at the same time.*

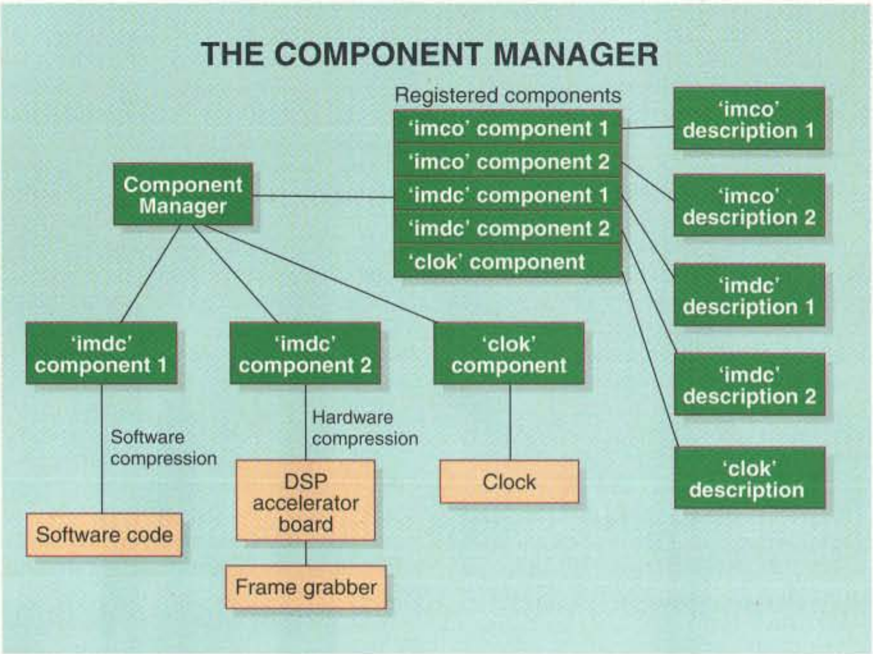

Figure 3: *The Component Manager functions as a database that classifies objects by function and provides run-time binding to functional objects using the standard Toolbox routines. It allows applications to find predefined classes of software and objects and registers hardware resources. Here,* `'imdc'` *represents the image decompression manager,* `'imco'` *represents the compression manager, and* `'clok'` *represents the system clock.*

The Component Manager

The Component Manager allows applications to find and use predefined classes of software objects at run time, and it enables external resources (e.g., digitizer cards) to register their capabilities with the system at run time (see figure 3). Before QuickTime, any applications developer who wanted to support digitizer cards had to write custom software for every device supported and change the software every time the hardware changed. With QuickTime's Component Manager, hardware is transparent to applications. The application merely makes a request to the Component Manager for a digitizer card with certain capabilities, and the Component Manager locates and communicates with components of that type. When you install a new QuickTime device, be it a frame grabber, video board, or DSP (digital signal processor) compression board, you just drop the QuickTime driver provided by the manufacturer into the Component Manager folder, and the new device operates transparently.

The Component Manager uses standard Toolbox routines to provide a database service that classifies software and hardware objects by function and allows applications to bind with functional objects at run time. It is designed to handle any kind of hardware or software module. Future modules that will be brought in via the Component Manager might include OCR (optical character recognition), color-matching schemes, and printing interfaces.

Given a particular function type, the Component Manager can locate and query all components of that type. The first step is to locate an appropriate component. The Component Manager does this with the high-level `FindNextComponent` routine. The Component Manager keeps track of many characteristics, including a name, an icon, and an information string for every component registered with the system. You can also find out how many components of a specific type are available and obtain additional details about a specific component's capabilities. Your application opens a connection to that component, and you can then use the component's services.

In this way, the Component Manager creates a level of abstraction between components and their client applications. Instead of implementing support for a particular data format, protocol, or model of a device, you can use a standard interface through which your application communicates with all components of a given type and use the Component Manager to locate and communicate with components of that type. For example, components of type `'imdc'` provide image-decompression services. All the components of type `'imdc'` share a common application interface, but each image-compression component may support a unique compression technique or take advantage of a special hardware implementation. Algorithm- or hardware-specific variations of the compression interface are implemented by each `'imdc'` component.

The Sound Effect

QuickTime sends audio information to the Sound Manager, which then sends the data to the hardware. This is the path a digital audio track takes to get from your hard disk to your Mac's speaker. The Sound Manager is a collection of routines that allow applications to create, edit, and play sounds directly from the Macintosh speaker or through the output jack of the computer—but it is not a part of QuickTime. Apple plans a new Sound Manager (which will still be separate from QuickTime) that will support high-quality 16-bit stereo sound hardware in addition to the Mac's internal speaker.

Individual components in QuickTime may support additions to the defined application interface, as long as they support the common routines. If you're using commercially available hardware, such as video I/O boards, sound boards, DSP accelerator boards, or dedicated image compressors, you will find that most manufacturers have chosen to implement an Apple-provided component on their hardware. However, you (or your card manufacturer) may elect to create your own component. You might do so in order to create an entirely new function, such as a new filter for a desktop publishing package; to add multimedia capability to a paint/drawing package; or to modify a component (e.g., adding MPEG [Moving Pictures Experts Group] audio compression to an existing MPEG video-compression component).

The Component Manager allows a single component to serve multiple client applications simultaneously. Each client has a unique connection path to the component, which maintains separate status information for each open connection.

QuickTime Components

QuickTime components are software objects, overseen by the Component Manager, that provide a defined set of services to client applications. QuickTime ships with dozens of components, including compressor components; movie controller components, which let applications play movies using a standard user interface;

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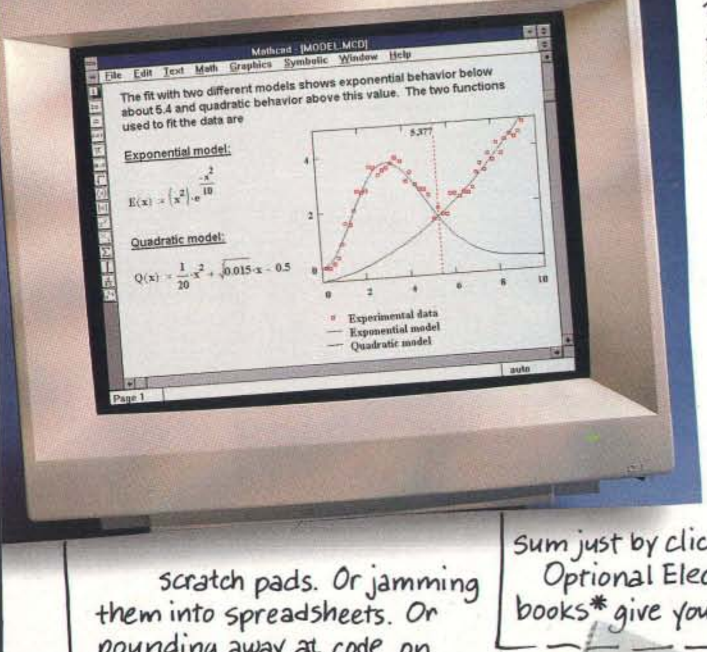

The fit with two different models shows exponential behavior below about 5.4 and quadratic behavior above this value. The two functions used to fit the data are

Exponential model:

$$E(x) := \left(x^2\right)\cdot e^{\frac{-x^2}{10}}$$

Quadratic model:

$$Q(x) := \frac{1}{20}\cdot x^2 + \sqrt{0.015}\cdot x - 0.5$$

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QuickTime: Hardware-Hungry

Few computer applications are as demanding as digital video. A QuickTime movie strains the capabilities of processors, memory, disks, video and audio circuitry, and the various pathways that join them, even on a Mac Quadra. Full-motion, full-screen, full-color video requires a data transfer rate of approximately 27 MBps. One minute of such a video requires over 1.5 GB of storage. To reduce storage requirements, QuickTime implements on-the-fly compression and is algorithm independent. However, many users may want to budget for an accelerator board.

For most users, software-decompressed video is limited to small windows and low frame rates. QuickTime 1.5 can play 8-bit, 160- by 120-pixel color movies at 24 to 30 frames per second, or 320- by 240-pixel images at 12 to 15 fps on a Mac LC II. The speedy Quadra 950 can play back 8-bit, 640- by 480-pixel color movies with monophonic sound at 24 fps—just short of the 30 fps required for full-motion video.

Working in a small image area is acceptable for augmenting spreadsheets and word documents with video and animation clips, but it is not appropriate for video-intensive multimedia applications that require larger images and faster frame rates.

Fortunately, QuickTime-compatible hardware tools are available for audio and video compression, frame grabbing, and acceleration of the video display.

Many boards include both NTSC and PAL inputs and outputs. Accelerator boards use dedicated chips, such as JPEG (Joint Photographic Experts Group) accelerator chips; RISC chips; and DSP (digital signal processor) chips. DSP chips are well suited for QuickTime acceleration because they can handle a variety of QuickTime tasks, including both audio and video compression as well as fax, modem, and telephony functions. Board prices range from $300 to $3000, depending on your needs (see "New Tricks for Slow Macs" on page 198). However, regular QuickTime users will find the investment worthwhile.

movie grabber components, which are data-handling routines that accept video and sound input and write data to QuickTime movies; clock components, which handle timing sources and information; previewer components, which allow applications to display preview information; and video digitizer components. Custom components may also be provided by hardware vendors.

The Component Manager classifies each of these components according to its type, the level of service it provides, and its manufacturer. It uses a four-character designator to identify the type of service a component provides (e.g., all image compressor components have a component type value of `imco`). All components of a given type support a common application interface.

The Component Manager lets components identify the service level they provide by specifying a four-character component subtype value. An image compressor component uses the component subtype value to specify the compression algorithm that it supports. The component subtype value is meaningful only in the context of a given component type, and all components of a given type/subtype combination support a common application interface. However, components that share a type/subtype specification may support additional application routines that are not part of the basic interface.

Finally, the Component Manager allows components to have a four-character code (published by Apple Developer technical support) that identifies the manufacturer of the component.

QuickTime could become a de facto cross-platform standard.

Evolution in Progress

QuickTime is an evolving technology. Apple's initial focus has been on bringing video to the desktop. Because video is resource intensive, Apple is continuing to improve software-decompressed video data rates. Most users, however, will want extra hardware to handle the burden (see the text box "QuickTime: Hardware-Hungry" above).

QuickTime still doesn't handle all media data types. For example, it has no facility for dealing with SMPTE data tracks, a standard in the video-editing world that QuickTime must support before it can be used in professional video-editing systems. QuickTime also isn't yet MIDI-aware and doesn't support CD audio systems, although Apple plans to add support for both.

On the video front, Apple is working with Avid Technology (Tewksbury, MA), a marketer of Mac-based professional video-editing workstations. The companies plan to merge QuickTime with Avid's Open Media Framework Interchange, Avid's file format for digital media compositions, along with the underlying data for both.

QuickTime's flexible architecture and hardware independence have earned respect from the Mac community. With support coming from Apple for Windows, and from third parties such as Silicon Graphics, QuickTime could take root as a de facto multiplatform multimedia standard for the 1990s. ■

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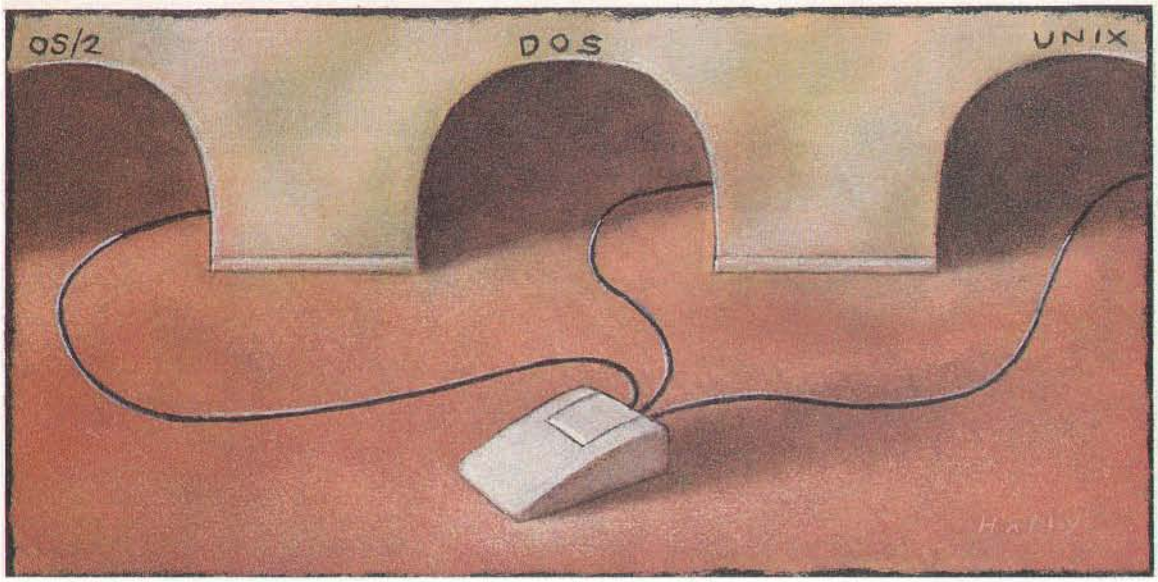
SOME ASSEMBLY REQUIRED

RANDALL A. NAGY

HANDLING INPUT EVENTS USING C++



The Event class manages mouse and keyboard input for DOS, OS/2, and Unix

Since standard C has no support for mouse and enhanced keyboard events, programmers working in character mode must use whatever facilities the operating system provides. MS-DOS conveys mouse events to your program by way of interrupts. Under OS/2, you might use a device monitor. Unix options include treating `/dev/mouse` as a stream, using `_ioctl calls`, or exploiting `signal` events. In this article I'll present a C++ solution to the problem of handling mouse and keyboard events—a solution that's portable to DOS, OS/2, and Unix.

Event is a C++ class library I originally developed to handle input from the DOS keyboard and mouse. Over time, I've extended it to OS/2 and Unix as well. Much as with Windows or OS/2 Presentation Manager, Event allows the DOS programmer a single point of entry to monitor all standard messages. Thus, the class supports the development of event-driven programs. I'll demonstrate how to use the Event class, and I'll examine the key structures and class members that enable the class to do its job. I'll also discuss why C++ is uniquely suited to the development of portable, maintainable, reusable modules.

The Event Class

Since Event was originally built as a C++ wrapper around lower-level operating-system keyboard and mouse routines, it has been easy to port to other operating systems. By using the C++ ability to hide platform-specific functions and data behind a class interface, I've been able to ensure that my code never used functions that would not be available to it on another operating system. The code I'll present here comes from the DOS implementation of Event.

When dealing with multiple sources of input messages, it's crucial to serialize those messages. For example, while typing in a string, a user might decide to press a function key instead, or to click on a mouse button. The Event class takes a two-pronged approach to handling this problem. I've overloaded its central method, `GetMessage`, to support two modes of message retrieval. One fetches input events of all types: characters, function keys, and mouse events. The other fetches whole strings and preserves noncharacter events separately. To use the class, a program calls `GetMessage`, which returns results in a structure called `MSG`. Other member functions exported by the Event class enable the program to get and set the mouse and cursor locations.

There's no need to initialize Event's data structures in order to use it, or to clean them up when you're finished. Nor need you worry about device (e.g., mouse) setup. That's typical of C++, which provides class *constructors* and *destructors* for these purposes. Constructors and destructors can handle setup and shutdown chores required by the class or the operating system and make

ILLUSTRATION: GREG HALLY © 1993

these issues transparent to the programmer. This transparent handling of device and class initialization ensures that by the time a program calls any members of the Event class, the method is primed and ready to do its job. In C++, class constructors and destructors carry the name of the class in which they are defined. As you can see in listing 1, the destructor carries a tilde in front of its name.

Constructive Coding

Because of the freedom from data and device initialization that class constructors and destructors provide, operating-system peculiarities used to control odd input devices (e.g., a mouse) can be safely tucked away inside class members. In DOS, this means that the command to turn on the mouse can be placed in the class constructor, while the chore of turning off the mouse is placed in the class destructor (see listing 2). Just declaring an instance of the Event class causes the constructor to run. When that instance goes out of scope, the destructor runs.

At its lowest level, Event merely loops through the various DOS device-monitoring interrupts, checking for input events—characters, function keys, and mouse-clicks. There are times, however, when you want more than a single message back from the keyboard—for instance, you might not want Event to return to you until it has read a string of a certain size. To deal with this requirement in standard C, you would quite naturally write another function to provide this new feature. The same is true in C++, but you get to reuse (*overload*) the function name. In the case of Event, I declared a primitive `GetMessage` function

```
DOSMSG
    *GetMessage(char *, int);
```

and an alternative, string-building `GetMessage` function

```
DOSMSG *GetMessage(BOOL);
```

When you call `Event::GetMessage(...)`, the compiler can determine which version to use only by inspecting the parameters specified in the call. Since the compiler can easily distinguish `Event::GetMessage(BOOL)` from `Event::GetMessage(char *, int)`, there's no problem overloading the function.

Note that class constructors and destructors are always placed in the *public* portion of the class definition. If the prototypes for these two class members were placed in the *private* portion of the class instead, not even the C++ class initialization code would be able to call them. As their names imply, public members of a function or structure can be accessed by anyone able to create an instance of the class. Private and protected class members, however, can be accessed only by *friend* functions or other class members.

In standard C, you can get much of the effect of the C++ private or public statement by defining functions as *static* in separately compiled files. However, in C++, the class permits these functions and other class members to reside within the same file, if desired. This ability to refer to static functions in other files not only eases the chore of code maintenance by providing a map of how the class is to be used, but also allows for functions to be easily swapped between public and private views.

The C++ class can free your program from operating-system dependencies.

Unlike with static functions in C, when you move individual functions between visibility scopes in C++ you need only move the prototypes among the various sections of the class definition: private, protected, and public. You needn't change the functions themselves, which may reside physically in other files.

Having seen the advantage of function-name overloading and additional class-member scope classifications, you can see how the C++ class can free your program from operating-system dependencies. Strange and cryptic device-level interfaces can be hidden in the private portions of a class, initialized quietly by class constructors, and exported to the rest of the world through a public class member. The application programmer need only know which public class members are exported and how to use them. The ability to rigidly define how a programmer is to use your code is a critical part of providing yourself with a portable interface into other environments.

Certainly the ability to overload names and hide class members has the effect of making a program more portable. However, when individual function names can so easily be overloaded, you can also see how C++ programs can be easier to develop and maintain. When a C++ function is modified, old programs can still keep their original entry points. If newer functions can differentiate themselves from older versions by at least one parameter (admittedly sometimes tricky), then obsolete functions don't have to be replaced—just overloaded and modified to call the newer version of the function. For the most part, old source code can remain virtually untouched.

Although you can get the approximate effect of function-name overloading in C by moving, for example, the old function prototype into a `#define` macro that maps the old function name over to the new name, the C++ method just described better documents what is taking place. Furthermore, since the old function can be entirely rewritten to support the requirements of the newer version of the function, C++ is much more powerful than simple macro substitution.

In cases where speed is important (i.e., where you don't want the overhead of another call to a member function), C++ provides the new concept of *inline functions*. An inline function operates exactly like a multiline `#define` macro (a feature not all C compilers support), substituting its entire function body wherever the inline function is called. In the struggle between space and speed, inline functions always save you the overhead of a function call at the expense of final execution-code size. Weigh the costs, and use these functions where appropriate.

The Event class has one inline function, `Event._mouse` (see listing 1). It's a private member function declared inline to avoid incurring the overhead of an additional call to the mouse-interface member function. I did this to speed up the call to the mouse interface, which is written in assembly language. (Note that the inline keyword in C++ is only a suggestion to the compiler.) Since the amount of assembly language in `Event._mouse` is small, the cost of inlining it is minimal.

Dealing with Data

With the overloaded `GetMessage` function, you saw how the parameters of the function call dictate which call you use, rather than the other way around. You might even say that overloading can make your programs data-driven, in a narrow sense. Note that C++ supports variable numbers of arguments to functions and even permits you to assign default values to those arguments if you need to.

continued

Listing 1: *The Event class.*

```
class Event {
  public:
    DOSMSG DosMsg;
    // Class overhead and management;
    Event();  // Class constructor
    ~Event();  // Class destructor
    // Mouse-specific functions;
    BOOL   HasMouse();
    POINT  WhereMouseXY();
    BOOL   SetMouseXY(int, int);
    // Keyboard-specific functions;
    int    WhereX();
    int    WhereY();
    POINT  WhereXY();
    BOOL   GotoXY(int, int);
    // Message retrieval;
    DOSMSG *GetMessage(char *, int);
    DOSMSG *GetMessage(BOOL);
    // Miscellaneous functions;
    void   BellAlert(BOOL);
  private:
   int    C1X;     // Keyboard cursor (cursor #1)
    int    C1Y;     // ibid.
   int    C2X;     // Mouse cursor (cursor #2)
    int    C2Y;     // ibid.
    int    BUTTON;  // 'L', 'R', NULL code
   int    CTRLKEY; // Second value of scan code
   int    bx, cx, dx; // Used for register calls
   BOOL   bMouseOn;  // TRUE = mouse installed
    BOOL   bBellOn;   // BEEP on error
    int    GetEvent();
    // inline 4speed;
    int    _mouse(int, int *, int *, int *);
    int    MouseStatus();
    // Return FALSE (0) if no mouse
    BOOL   MouseReset();
    // Only used for graphics mode
    void   install_cursor_image(void); };
```

Listing 2: *Event's constructor and destructor.*

```
Event::Event(){
   CTRLKEY = NULL;
   bBellOn  = TRUE;
   // Return TRUE if mouse installed
   bMouseOn = MouseReset();
   if(bMouseOn == TRUE) {
      bx = cx = dx = 0;
      // Turn the mouse on
      _mouse(MOUSE_ON, &bx, &cx, &dx);
      // Set C2X, C2Y, and BUTTON
      MouseStatus();}
   // init keyboard stuff
   WhereXY();
      _setcursortype(_NOCURSOR); } //Event()
```

```
Event::~Event(){
  if(bMouseOn == TRUE) {
    // Turn the mouse off
    bx = cx = dx = 0;
    _mouse(MOUSE_OFF, &bx, &cx, &dx);
  } else {
    // Destruct keyboard stuff
    // (not needed on DOS)
  }
    _setcursortype(_NORMALCURSOR); } //~Event()
```

Listing 3: *Checking for Windows enhanced mode.*

```
; *******************************
; Check for windows 3.0, 2.0
; AL = 1 if found, else AL = 0
; *******************************
is_win30 proc near
   mov  ax,1600h ;test for enhanced mode
   int  2Fh
   or   al,al    ;extended check, AL==00h
   jz   rstest
   cmp  al,80h   ;extended check, AL==80h
   je   rstest
found_it:
   mov  al,1;    ;set AL
   ret           ;return found
rstest:
   mov  ax,4680h ;see real or standard?
   int  2Fh
   or   ax,ax    ;if AX==0
   jz   found_it ;then we got it
                 ; else
   xor  al,al    ;reset AL
   ret           ;return not found
is_win30 endp

; *******************************
; Check for Windows 3.1
; CX = 3 enhanced, CX = 2 standard mode
; *******************************
is_win31 proc near
   mov   ax,160ah ;windows there?
   int   2fh
   ret
is_win31 endp

; *******************************
; Give up time slice to Windows VM
; *******************************
to_win31 proc near
   mov   ax,352fh      ;get DOS vector
   int   21h
   move  ax, es
   or    ax, bx        ;Is it there?
   jz    no_need       ; nope...
   mov   ax, 1680h     ;back to windows
   int   2fh           ; give it up
no_need:
   ret
to_win31 endp
```

A simple, single data structure lies at the heart of the Event class. In the DOS implementation, I've named that structure DOSMSG. Although the data structure can differ from platform to platform, that wasn't required for the Event class: The structure was entirely adequate for the way events are gathered in OS/2, Unix, and DOS. However, if you need to prevent other classes from accessing some portions of a structure, then C++ allows you to declare parts of a structure private or public in the same manner as you would for a class. The default scope for class members is private, however, whereas the default scope for data structures is public.

When a DOSMSG structure is detected, `Event::GetMessage(BOOL)` returns a pointer to a structure that identifies all the information generated by the message. For example, mouse messages contain both the point at which they were generated (in the standard PC coordinate system, where 0,0 refers to the upper left corner of a positive coordinate plain) and what event caused the message (e.g., left mouse button or function key). Keyboard messages, on the other hand, contain a keystroke identifier and the location at which the key was pressed.

The message structure is declared as follows:

```
typedef struct tagDOSMSG
{
int Type; // (key, mouse, etc.)
int Msg; // KEYS.H if key,
   // or mouse-message-id
POINT pt; // location
} DOSMSG;
```

POINT is just a pair of integers. This structure is sufficient to convey all keyboard and mouse activity to programs on three operating systems. The `DOSMSG.Msg` value is a signed integer; however, those desiring better support for double-byte characters might want to change the type to unsigned.

Using the Event Class

Once a class has been defined, C++ allows you to use it directly or to derive a new class from it that inherits (but can redefine or extend) its functions and data. To subclass Event, you would use the following syntax:

```
class MyEvent:public Event{..};
```

This says, "Create a new class named MyEvent based on the public portion of the Event class." If you just want to use the class directly without any further modification, you need only declare an instance of it. You can do this either with the C++ `new` operator (close cousin to C's `malloc`), or on the stack with a declaration like

```
Event InstanceOfEvent;
```

which calls the class constructor `InstanceOfEvent.Event` without further intervention. In C++, class constructors can have arguments and, like other class members, can be overloaded. Aside from being called once when the class is created, class constructors cannot be called by nonmember functions. Class destructors, on the other hand, can be called by anyone at any time and typically are not overloaded.

Here's how you declare and then use an instance of the Event class:

```
DOSMSG *pMsg;
Event InstanceOfEvent;
// Constructors are called
pMsg =
   InstanceOfEvent.GetMessage
      (BOOL);
```

This call to the overloaded function `GetMessage` in class Event will return the proper result: a pointer to a message structure.

When I first learned C++, I was intrigued by the ability to apply the C array operators ".," "*," and "->" to any class member. Unlike standard C, C++ allows pointers to classes, data, and functions within classes to be manipulated just like C arrays. If you wanted to pass a pointer to Event to another set of routines that would need to work with the class, you could use pointers in this way:

```
main()
{
Event myEvent;
..
ReadSomeData(&myEvent);
// The "&" is required.
..
}

ReadSomeData(Event *pEvent)
// Could also be a void *!
{
MSG *pMsg;
..
pMsg =
 pEvent->GetMessage(&pMsg);
..
}
```

Once again, note that passing function pointers around is something you can handle in standard C (perhaps with a few cleverly defined macros tossed in for good measure), but in C++ your code will be much more readable and easier to maintain over time.

You may have noticed that under DOS, Event spends much of its time polling devices. On preemptive operating systems like OS/2 and Unix, this polling activity is not much of a problem, since sharing the CPU is accomplished by the kernel, without your program's knowledge. Sharing the CPU under DOS, however, is a real issue.

Fortunately, running Windows in enhanced mode allows the 386 processor to run a DOS program in its own VM (virtual machine). This means that preemptive, nondeterministic multitasking can take place. Listing 3 shows how Event can detect that it's running in a Windows enhanced-mode VM and surrender time to Windows.

You might also want to execute another internal function while Event is checking for input. In such cases, Event could easily be modified to accept a pointer to a class (or to a single function) that would be called while Event was waiting for user activity. In this manner, the Event class itself could also provide your program with a platform-independent method for simple multitasking.

The C++ Advantage

I have focused on some of the practical aspects of using C++ in real-world programming situations, rather than on the more academic discussions of the advantages of using object-oriented programming techniques. The key advantage of using a language like C++ is not so much that it can do things that no other language can do, but that it can help you think in ways that you otherwise might not have considered.

Learning object-oriented design concepts and adapting them to the way you write your code today can also make porting and maintaining that code much easier in the future. However, there's no substitute for good design. If you start with a good one, C++ will help you maintain it over time. ■

Editor's note: *The complete listings described in this article are available electronically. See page 5 for details.*

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SOFTWARE CORNER

BARRY NANCE

A SMALL BROWSER WITH EVERYTHING

What features could I possibly offer in a DOS-based browse utility to make you switch from what you've got? Superfast access to large files might tempt you. The ability to spawn the file browser as a resizable text window from within a program should pique your interest. LAN awareness (i.e., file sharing) is a possibility; it's more a necessity than a luxury these days.

How about fast search operations using the Boyer-Moore algorithm? If you're still not convinced you'd want it, what about having the source code at your disposal for customization or incorporation into other programs? This month's selection is LIST, a file browser that incorporates all these features into a simple but quite handy utility.

Eyeing the Browser

Some DOS-based file browsers operate slowly on large files or can't process them at all. To avoid this problem, I designed LIST to sometimes treat a file as a collection of lines of text and sometimes as a random-access set of blocks of characters.

LIST is a text-viewing utility with all the extras

This unusual mixture of line-oriented and random-access file I/O lets LIST move quickly through a file and still display the result in textual form. You can view the end of a 100-MB file about as quickly as you can view the next screenful.

If invoked with no command-line parameters, LIST asks for a filename. You can give LIST a single parameter—a file specification indicating the files you want to see—and the browser will operate in full-screen mode. You can use four additional parameters (i.e., the corner coordinates) to make LIST window itself on the screen.

You can run the executable file as a child process from almost any language (or shell to it from BASIC). From C, you could use the following to spawn LIST as a window in the middle of the screen, showing all the files in the current directory:

```
spawnl(P_WAIT,"list.exe","*.*","4","10","22","70",NULL);
```

In addition to using the cursor and other keypad keys for scrolling and paging, LIST has a toggle key for wrapping lines at the right side of the window and displaying a file in either hexadecimal or ASCII form. The bottom line of the browser's screen shows the file's size and the date and time the file was last updated. LIST restores the screen upon exit, so you don't lose track of what you were doing when you launched. Finally, you can shell to DOS from within the browser.

When you search for text in a file, you tell LIST whether the search should be case-sensitive. LIST uses the Boyer-Moore algorithm to move quickly through the file. (Having the source code to the search routines may be reason enough to get LIST.)

I used Borland's C compiler to develop LIST, taking advantage of Borland-specific library routines such as `clrscr()`, `clreol()`, `gotoxy()`, and `textattr()` to make life easier. You can use any version of Turbo C or Borland C++ to personalize LIST. ■

MAC/Tom Thompson

Pump Up the Finder

A common complaint against System 7.0 is that copying files takes longer. Because the System 7.0 Finder lets you run copy operations in the background or abort them with a mouse-click, it needs to take brief breaks during the copy process. These breaks allow CPU time for the Mac OS (to handle user events) or other applications.

SpeedyFinder7, a shareware Control Panel by Victor Tan, does some clever patching to speed file copies without sacrificing usability. SpeedyFinder7 allocates larger buffers (whose size is determined automatically or by the user) to read more data blocks and boost file-copy throughput. My timings show that the file-copy time for sending files through an Ethernet network was halved, while the time for copying files between hard drives was reduced by nearly a third. SpeedyFinder7 also eliminates the zoom rectangles that appear when an application launches, and it displays icons that indicate floppy disk type.

UNIX/Ben Smith

A Programming Perl

There are several ways to run a recursive-directory `grep` (i.e., search for a regular expression in all the text files in a directory tree). For example, you could issue the following command string: `find . -type f -l -exec egrep` *`search-string`* `{}\`. You could also write a more flexible recursive `grep` in C, but that's hardly a trivial matter to accomplish.

If you choose Perl instead of C, however, the task gets a lot easier. Piet van Oostrum's excellent freeware, an `rgrep` Perl script, shows this simplicity. He's implemented `rgrep` in just 184 lines of Perl, and his program includes a help menu and a handy collection of options.

Van Oostrum's `rgrep` also does things that would be difficult or impossible with the `find` and `egrep` combination, like silently skipping binary files and scanning compressed files intelligently.

Editor's note: *Software Corner highlights public domain, freeware, and shareware programs. The programs are available electronically. See "Program Listings" on page 5 for details. We solicit your contributions. We pay $50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*

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Ease of Install/Upgrade	8.9	8.0	8.8	7.8	8.1	6.3
Price/Perform Return	9.1	8.3	8.5	7.9	8.1	7.4
FUNCTIONALITY						
Flexibility	9.1	8.8	8.6	8.4	8.4	7.6
Interface Capabilities	8.9	8.9	8.4	8.1	8.7	7.4
Comprehensiveness	9.1	8.8	8.8	8.3	8.7	7.6
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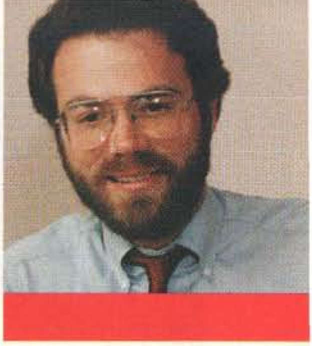

MARK J.
MINASI

A NEW OS/2

There is no shortage of good news this month. By the time you read this, IBM should have released a new version of OS/2 (called 2.01 as this went to press) that's not only faster in the graphics department but also supports Windows 3.1 binaries. And developers will love the Professional Developer's Kit CD-ROM, which contains every piece of IBM software even vaguely related to OS/2.

ServicePak

Although the new version of OS/2 should be generally available by the time you read this, I've been working with IBM's ServicePak, which updates your current copy of OS/2 2.0. You can find the upgrade either in the IBMOS2 forum on CompuServe or on IBM's BBS at (404) 835-6600, or you can order the disks for $24.95 by calling (800) 342-6672.

The ServicePak includes major improvements in the Micrografx 32-bit graphics engine, and support for Windows 3.1 binaries is on the way. Other improvements include ISO fonts and a Super VGA driver.

The graphics engine visibly improves the GUI speed on OS/2 2.0. For example, moving windows around on the Workplace Shell desktop is quicker. But it's not *exceptionally* faster, and it took me a few minutes to figure out why. Much of what makes graphics fast or slow is the graphical driver, and the basic VGA driver that I'm using on my OS/2 system (none of the generic ET4000 drivers seems to work on my system) still employs mainly 16-bit code. But having the internal manipulations run faster has provided a boost to system performance. Perhaps 32-bit VGA drivers for us local-bus users will appear one day or, as I imagine in my fondest dreams, perhaps S3 accelerator drivers.

There are still some annoying aspects to OS/2 that have not been addressed in the latest update. Like many OS/2 users, I boot OS/2 on some days and DOS on some others, using the `boot/dos` or `boot/os2` command. Doing this, however, leads to a mildly problematic disk condition that CHKDSK refers to as "cross-linked extended attributes." There seems to be nothing one can do about this except to run CHKDSK from a floppy disk.

To this point in OS/2 history, this problem has been, in general, innocuous. The updated OS/2, however, seems a bit more sensitive to it than previous versions; I was unable to open my Drives folder until I booted from a floppy disk (no small task in the OS/2 world, as those who've done it know) and then used CHKDSK to eliminate the cross-linked extended attributes.

On the other hand, the Windows 3.1 support in this release is very good—better, in fact, than I expected. The common dialog boxes have appeared for opening files and printer and font selection, and the Program Manager looks just like Windows 3.1's Program Manager.

IBM's ServicePak and a new CD-ROM bring a flood of OS/2 goodies

The speed of video operations matches that of 3.1. There are even some video operations that are faster under OS/2 than under 3.1. OS/2 doesn't appear to incur much extra overhead. The bottom line: If you've been avoiding OS/2 solely because you're afraid that it won't run as quickly on your system as Windows will, you no longer have a reason not to run OS/2.

There is, however, an oddity about this release. Since April, IBM has released many patches that speed up the system or make it more stable. Perhaps the most famous is the file IBM1S506.ADD, which is a driver for hard disks that emulates the standard ST506 interface on ISA-bus machines. Downloading and adding IBM1S506.ADD speeds up disk access wonderfully under OS/2, and anyone who's not got this file yet should definitely get it. IBM advises you to download and apply the ST506 patch to the ServicePak-equipped OS/2. I'm not sure why IBM didn't just put the updated drivers and patches in the ServicePak, but I'm using the beta version; perhaps the final version won't have this problem.

OS/2 Freebies

I got the Professional Developer's Kit CD-ROM disc in the mail the other day, and my first thought was, "Hallelujah!" Anyone who's installed OS/2 from floppy disks knows that disk flipping gets a bit old after you've reinstalled OS/2 for the third time. The idea that the whole bloody thing can be installed with just a few commands is the best news I've had since I started working with OS/2 five years ago.

After a bit of fiddling and some advice from some very helpful people at IBM, I got the thing running. It was truly great to finish an entire OS/2 installation in just a few minutes. I called the IBM folks who'd

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helped me to tell them how simple it turned out to be, and I asked how they planned to sell this CD-ROM version of OS/2.

"We're giving it away," they replied. I had to ask if I'd heard them correctly. I had, but there was a catch. This is all beta software, and IBM doesn't plan to release the final CD-ROM with all the software that's on this disc. It turns out that there's a lot more on there than just OS/2.

I hadn't looked at first. Since it's a developer's product, I figured I'd find a C compiler, a linker, some libraries, a debugger kernel, and the latest OS/2 beta version. But when I looked closer, my mouth dropped open. Besides the ServicePak, it includes the latest C/2 compiler, the debugger kernel, LAN Server 3.0 (server code, as well as requesters for DOS and OS/2 workstations), NetWare and TCP/IP code for OS/2 2.0, the Developer's Toolkit (containing tons of goodies and sample code along with several books, including the "red books" IBM distributes with technical information on OS/2 and PS/2s), and several productivity tools.

There's more on this disc than buyers of the original OS/2 1.0 SDK (Software Development Kit) got for $3000. The productivity tools consist of a nifty collection of Presentation Manager utilities, including a magnify tool that works like the zoom tool shipped with the Windows SDK, a program that creates a single-disk bootable floppy disk for OS/2, a simple drawing program, a program-execution timer, a world globe viewer that shows the part of the world currently in daylight and the part that's in darkness, a screen-capture program, and many others.

Visual Rexx

Of all the productivity tools on the disc, I've played mostly with a single item that appeared down on the bottom of the list: Visual Rexx, a command scripting language that's similar to the DOS batch language, a TSO `clist`, a CMS `exec`, or a Unix shell script.

I'm not the world's greatest fan of C programming. That's not an indictment of C programming or C programs; it's just one man's opinion. I'm not a professional programmer most of the time; I mainly consult, teach seminars, and write books. The only code I write these days is small utilities.

I loved Visual Basic for Windows for this reason: I could bang out a quickie utility in a few hours, even if I hadn't picked up Visual Basic in a few months. It's easy to learn, and it provides immediate gratification. I have grumbled many times about the fact that Microsoft has a Visual Basic for OS/2—the Visual Basic manual is riddled with references that say things like "if you've got the OS/2 version of Visual Basic..."—but refuses to sell it.

What a pleasure it was to find Visual Rexx, which is much more powerful than the DOS batch language and has been supported in the OS/2 Standard Edition since version 1.3. But Rexx, like most procedural languages, has been slow to support GUIs directly. Visual Rexx solves this by simply adding a few functions to the basic Rexx repertoire that allow you to write Rexx routines that can put windows on the screen, draw objects, display text, and do all the things that you need done to build your own small Workplace Shell routine. In just a few lines of code, you can put up File/Open dialog boxes and build windows, listboxes, radio buttons—you name it.

Notice I said that Rexx is suitable for building *small* routines. There's no getting around the fact that Visual Rexx is interpreted, rather than compiled. But it's still pretty fast; a Visual Rexx routine I wrote to run under OS/2 2.0 outpaced a similar Visual Basic routine under Windows 3.1 on the same machine. If IBM decides to ship Visual Rexx with all copies of OS/2—even the nonbeta ones—then it could get a real leg up on Microsoft, which makes Visual Basic an extra add-on.

But to get back to the Professional Developer's Kit itself: What is its future, and how do you get a copy? The IBM folks I talked with said that they intend to update it with new products, but only beta products. The license agreement on all the software expires when the shrink-wrapped version appears; for example, the November release of LAN Server 3.0 made my license for the beta version evaporate. If you like the beta product, IBM wants you to *buy* the final product—not an unreasonable request when you consider that the beta product doesn't cost a dime.

At this writing (late fall 1992), IBM was offering this CD-ROM free to any member of the IBM DAP (Developer's Assistance Program). You can get a DAP application by calling (800) 342-6672, by leaving a message in the OS2DEV forum on CompuServe, or by visiting an IBM booth at any trade show where the DAP exhibits. Get it while you can: It's possible that IBM may decide to restrict this to "professional developers," whatever that means. ■

Mark J. Minasi is a technical educator and author. His Arlington, Virginia–based firm runs seminars on advanced PC operating systems. He has recently authored Inside OS/2 2.0 *from New Riders and* The Windows Problem Solver *from Sybex. You can reach him on BIX as "mjminasi."*

ASK BYTE

Type Contention

I upgraded from Windows 3.0 and Adobe Type Manager to Windows 3.1 a few months ago, and I'm having a problem using the TrueType screen fonts. I have a 486/33 with 16 MB of RAM and a Diamond Stealth video card with 1 MB of RAM. I'm running Windows at a resolution of 800 by 600 pixels.

The problem occurs when I'm typing a letter in Word for Windows and highlight words in boldface or italic. When I type the word *have* in boldface, every subsequent instance of the letters *h*, *a*, *v*, and *e* on that line appears as a mix of normal and boldface text. This behavior sometimes continues throughout the whole document. Occasionally, I'll go to the original line and delete a character, and Word acts like it updated the whole screen because that line corrects itself. Because of this, I find it a nuisance to work with TrueType fonts and have stuck with ATM.

Any idea what's wrong?

Eric Carlino
Glenview, IL

Your problem is a conflict between TrueType and ATM. Windows is confused because it doesn't know which screen font to display. Either use ATM (go into the Windows control panel and turn off the TrueType options) or disable ATM. Trying to use ATM and TrueType simultaneously will continue to cause problems.—Stan Wszola

Document Management for the Next Computer

I am interested in information on search-and-retrieval systems. This system must work with a scanner. I'd like to be able to fax from my machine and perform text retrieval on this data. I expect to manage 100 to 300 documents per day. About 75 people will have access to this data, possibly through a WAN (wide-area network). We would run this under Unix on Next computers and possibly Wyse terminals. Do you have any recommendations?

Cindy Castillo
Austin, TX

When we think of document management and Unix, we usually think of large, custom-developed systems that manage terabytes of information. A good example is the system at the U.S. Patent and Trademark office. Even though the databases may still be huge (e.g., the University of Toronto has a Kodak optical jukebox–driven, terabyte-size system), the user interface is much more to the scale and taste of the nontechnical user, and the workstations are from Next. You may see the result of that project appear as a commercial product shortly.

There's also a need for document management systems that are on the megabyte to gigabyte scale, like yours. There are a wide spectrum of products for personal computers. For the Next computer, you can look in Next's third-party products catalog. One product that fits your needs is Document Manager, which is available for $995 from Boss Logic (1901 Landings Dr., Mountain View, CA 94043, (415) 903-7000; fax (415) 903-7009).

For the scanner system you want, you might try the OCR Servant products from HSD Microcomputer U.S. (1350 Pear Ave., Suite C, Mountain View, CA 94043, (800) 828-5522 or (415) 964-1400; fax (415) 964-1538). Evaluate them carefully, as BYTE has not tested these products.—Ben Smith

Addressing the Hardware

I'm an Amiga user, and I recently received an IBM PS/2 for controlling a robot I'm building. I can figure out how to build a card, but I have no idea how to address it from Borland C. Do I need to know which card slot it is in, or do I set the address on the card itself? Also, how do I address I/O space and not system space?

Jonas Klein
Northfield, MA

The system architecture of Intel-based machines like the IBM PS/2 is significantly different from that of Motorola-based machines like the Amiga. Amiga peripherals are memory-mapped into the system address space. Although interface cards may also be memory-mapped in the Intel architecture, the PS/2 has a separate I/O bus for communicating with peripherals.

Whether you decide to use the I/O bus or memory mapping to communicate with your peripheral card, you need to decode the addresses on the card itself. The Micro Channel interface adds a level of complication since, to meet specifications, Micro Channel boards should provide the ability to dynamically configure their address I/O ranges using a setup utility. However, it is possible to inform the Micro Channel bus that your address ranges are hard-coded and cannot be adjusted. This is probably suitable for an experimenter's hand-built card, although it's unsuitable for a commercial product.

Once you've solved the hardware problem, communicating with the card from a high-level language is straightforward. Borland C provides low-level calls called OUTPORT and INPORT for writing and reading words. Bytes can be written with OUTPORTB and INPORTB. Microsoft compilers provide similar capabilities. It is also rather simple to write the low-level interface code in assembly language and call that directly from your C applications.—Raymond GA Côté

TV vs. Computer

When I turn on my 386 computer and Super VGA monitor, they send noise through the house wiring. The TV reception through the antenna gets fuzzy, and the situation has become a bone of contention with my family. What's happening, and how do I fix it?

Andre Segui
Clermont, GA

You're going to get RF radiation from all parts of your computer—that's the nature of the beast. RF radiation *can sneak out of the equipment through the case openings, the case itself, cables, modem connections—you name it. Too much, and you start to obliterate radio and TV reception.*

To minimize the problem, make sure that all your equipment is rated for FCC Class B certification (i.e., consumer-equipment certification) and that your machine is installed with all the manufacturer's case parts in place. Keep your cables as short as possible, and use good-quality wire for video, modems, and printers—shielded if possible. For the TV antenna, a good-quality 75-ohm shielded cable will filter out a lot more noise than a standard flat 300-ohm cable. Keep the computer as far from the TV as possible, and try to plug it into a different circuit if you can.

If all else fails, invite the rest of your family to use the computer, and get them hooked on it. If they appreciate having one in the house as much as you do, perhaps they'll stop complaining!—Howard Eglowstein

Not Ready Reading Drive A

I'm writing a DOS data acquisition program that writes data to the disk. I'd like to intercept any errors generated when the program tries to write to a floppy drive (i.e., A or B) that doesn't contain a floppy disk. I work mainly in FORTRAN, with some subroutines in assembly language.

I've tried using FORTRAN's INQUIRE command and several INT 21h variations, but I'm still getting "Not Ready Reading Drive A - Abort, Retry, Fail?" messages. Commercial packages handle this. How can I?

Bert van de Burgt
Tallahassee, FL

DOS handles disk errors through its critical error handler, INT 24. When an error occurs while trying to read to or write from a device, DOS sets the processor registers with error codes and other information and executes an INT 24. The default error handler gives you the "Abort, Retry, Fail?" prompt, but you're free to install your own handler. That's how the commercial packages do it.

Before accessing the disk, make sure your program takes control of INT 24. If something goes wrong, your program's handler will get control and can handle the error any way it wants to. Any good DOS programmer's reference will have the details of how INT 24 works.

—Howard Eglowstein

Macs on the Internet

I have noticed an increase in information on the Internet and how to reach it. The on-line services provide convenient E-mail, but is it possible to have a network connection on a Mac with a dial-up service?

I have used NCSA Telnet with FPT to transfer files to a Silicon Graphics Iris Indigo, but both machines were connected by the Ethernet. What software is needed to make a connection to an Internet provider? Can a Mac have an IP connection without running a form of Unix?

Bruce Hamilton
aol.com!bhamilton

I'll start with your last question first to put things in perspective. Yes, a Mac can have an IP connection without running Unix. You need MacTCP and a Control Panel that implements the TCP/IP stack on the Mac OS. You'll need the latest version of MacTCP (1.1.1) to operate with System 7.1. To obtain it, order the MacTCP 1.1.1 Developer's Kit from APDA, Apple Computer, P.O. Box 319, Buffalo, NY 14207, (716) 871-6555; fax (716) 871-6511. Ask for part number B0944LL/A, which sells for $100.

Next, obtain an IP number from your network administrator. This address is required to configure MacTCP, and you need a unique one so that when your Mac operates on the network, it won't conflict with other computers' IP addresses. With MacTCP installed, you can connect to Unix workstations using TCP/IP over the Ethernet in two ways.

If your Mac is connected to the network with LocalTalk, you need a router (e.g., the Cayman Systems GatorBox CS or Shiva's FastPath 5) to transfer the TCP/IP traffic between LocalTalk and the Ethernet. With this arrangement, you'll definitely need the network administrator to set up the IP number, plus any additional information the router might require to handle the address mapping between the two networks. If you've already cabled to the Ethernet, either through an Ethernet board or because you're lucky enough to own a Mac Quadra, you simply need to get an IP address.

Now for your first question. You are familiar with NCSA Telnet, which requires MacTCP to provide the TCP/IP communications that are required. The latest version of Telnet (2.5) supports both serial and SLIP connections. The serial connection establishes a console window-style session with a remote Unix system. SLIP establishes a serial connection that resembles an actual Ethernet connection. You'll need a modem, the phone number of the host system's modem, and a log-in name and password.

To establish the serial connection, you check the serial/SLIP box in Telnet's Open Connection dialog box. In the window that appears, you type the phone number of a Unix workstation that operates as a terminal server. When the connection is made, you use the name and password to `rlogin` *into the system. For SLIP, you'll need the phone number of the host system's modem and its IP number. Also, the host system has to be configured to recognize and handle a SLIP connection. For more information, consult the Telnet 2.5 documentation files, which are available on most on-line networks.*

Why did I mention the Ethernet connection when you want to connect to a remote site? Because an Internet connection might be only as far away as your Unix wizard. At BYTE, I use MacTCP and Telnet 2.5 over the Ethernet to log into bytepb, a Unix workstation whose duty is to handle our Internet mail. This saves me the effort and expense of contacting a remote system. It's like dropping the mail off at your local post office, confident that people (or mechanisms) behind the scenes will make the appointed rounds.—Tom Thompson ■

The BYTE Lab welcomes your questions. Address correspondence to Ask BYTE, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send BIX mail c/o "editors."

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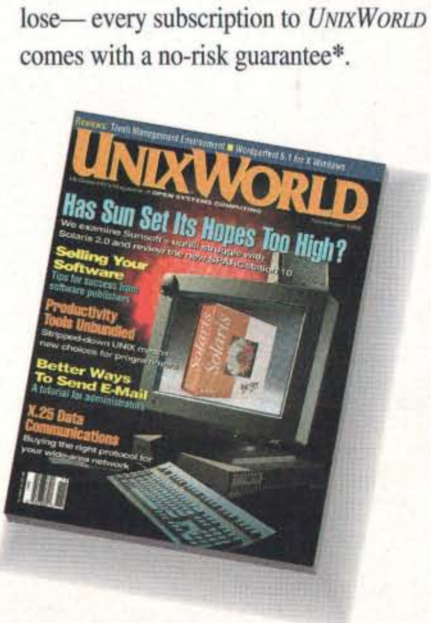
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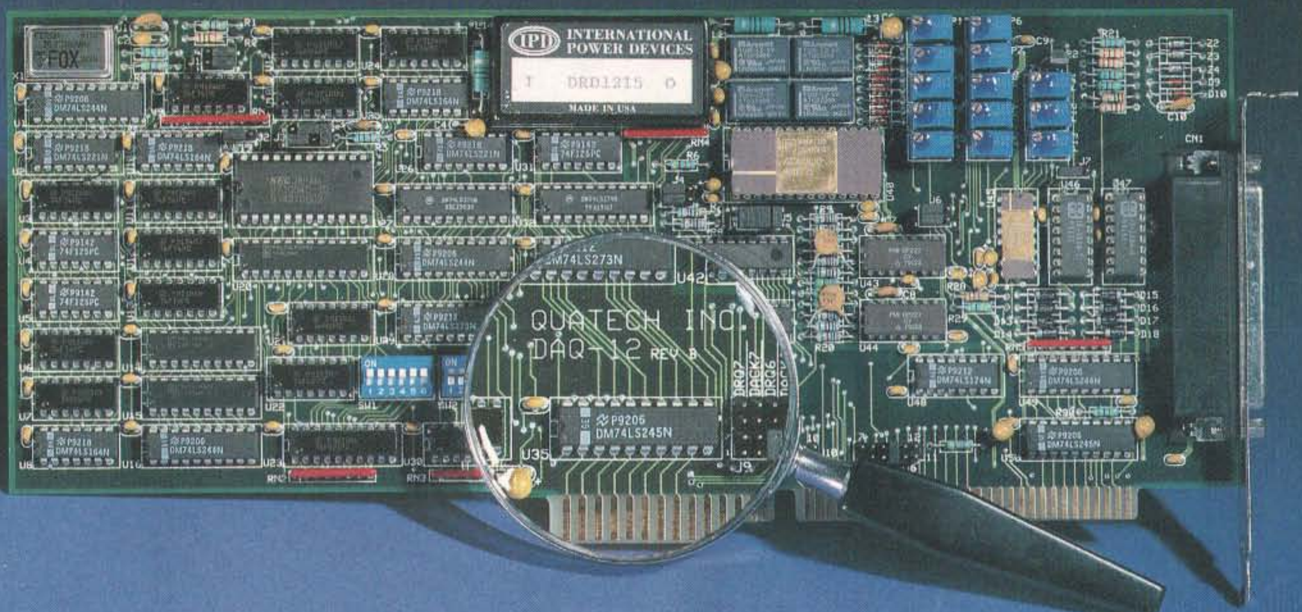

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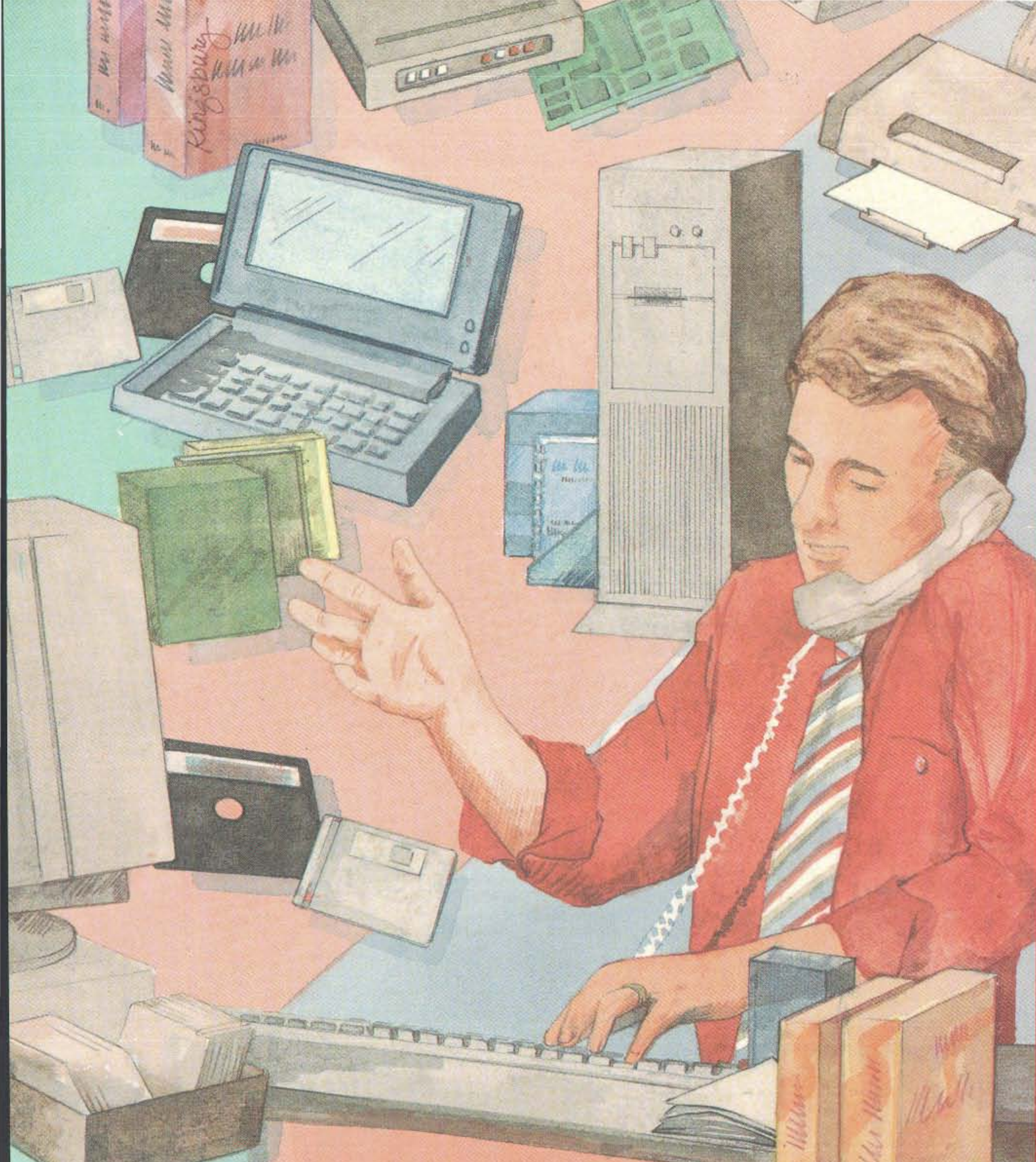

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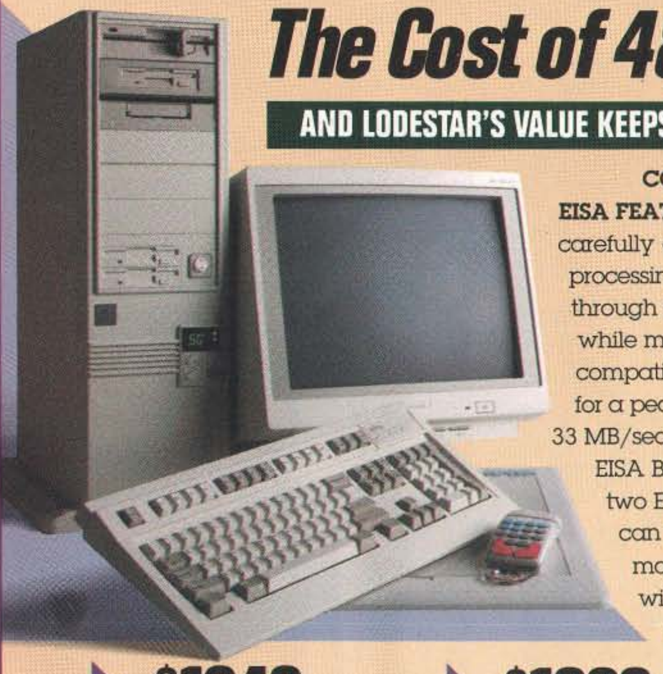

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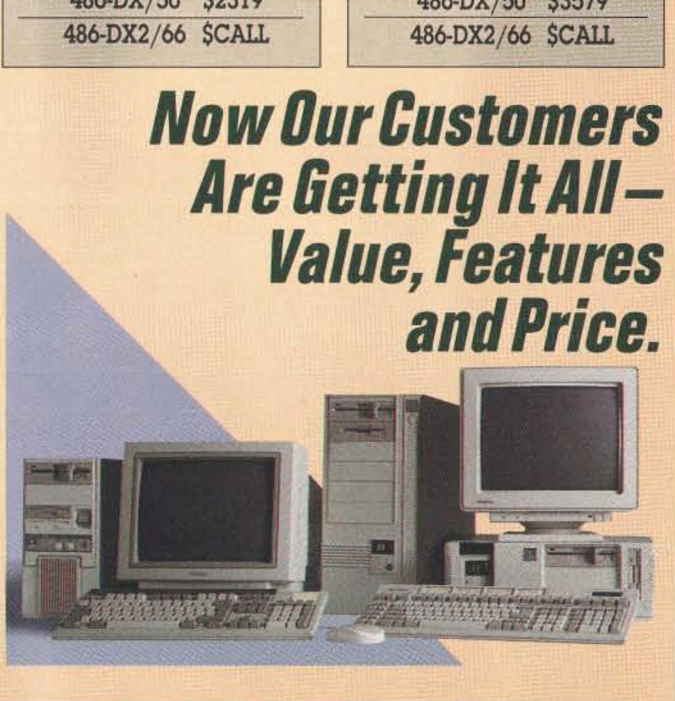

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NOTEBOOK -NX20	
1MB	CALL
2MB	CALL
4MB	CALL
NOTEBOOK 325NC	
2MB	CALL
4MB	CALL
8MB	CALL

EPSON

NB-SL/20, /25, /25C	
2MB MOD A808771	$ 128
4MB MOD A808781	199
NB3S	
1MB MOD A808501	110
4MB MOD A808511	190
EQUITY LT-286E	
1MB MOD A80891	129
EQUITY LT-386SX	
2MB MOD A808361	235
EQUITY 286 PLUS	
1MB KIT A808231	52
2MB KIT A808101	83
EQUITY 386SX/16 PLUS	
EQUITY 386/20 PLUS	
1MB KIT A808231	52
2MB KIT A808101	83
8MB KIT A808631	299
EQUITY 386/25 PLUS, 386SX PLUS	
1MB KIT A808231	52
2MB KIT A808101	88
EQUITY 386SX/20 PLUS	
1MB KIT A808231	52
2MB KIT A808101	68
8MB KIT A808631	299
EQUITY 486SX/25 PLUS	
1MB KIT A808231	52
2MB KIT A808101	80
486/33, 486SX/25 EISA & TOWERS	
2MB KIT A808591	$CALL
8MB KIT A808711	$CALL
16MB KIT A808671	$CALL
EPL 6000 L-P	
2-4MB E-C 105401	104
4MB E-C N/A	185
1MB KIT N/A	49
EPL 7000 L-P	
2-4MB E-C C822011	225
4MB E-C C822081	349
1MB KIT N/A	59
1.5MB KIT N/A	69
EPL 7500 L-P	
2-4MB E-C C822051	$CALL
3MB E-C C822021	$CALL
1MB KIT N/A	59
ACTION LASER II	
1MB E-C	80
2MB E-C	125
3MB E-C	165
5MB E-C	210

ALR

ALR POWERFLEX	
ALR FLEX CACHE 386SX	
512K KIT 12900512	$ 25
1MB KIT 12901000	45
2MB KIT 12902000	88
4MB KIT 12904000	156
ALR BUSINESS VEISA	
ALR BUSINESS VEISA ARRAY	
ALR MPS	
1MB KIT 12901000	49
4MB KIT 12904000	156
16MB KIT 12916000	525
0-32MB E-C 12407480	182
ALR BUSINESS STATION	
ALR POWER PRO	
ALR POWER PRO ARRAY	
ALR POWER PRO/MC	
ASLR POWER FLEX FLYER	
1MB KIT 12901000	49
4MB IT 12904000	156
16MB KIT 12916000	525
ALR POWER CACHE 486-486E	
ALR MICROFLEX 3000	
2MB KIT 12902000	89
8MB KIT 12904000	156
32MB KIT 12916000	1050
ALR FLYER 32LCT	
1MB 12902801	53
4MB 12901804	155
16MB 12904816	525
ALR FLYER 32DT	
1MB M1032LLA	98
4MB M1033LLA	246
6MB N/A	357

EVEREX

TEMPO LX	
2MB MOD N/A	$ 82
TEMPO CARRIER	
2MB MOD N/A	152
STEP SYSTEMS 386IS, 386SX/20	
512K KIT N/A	21
1MB KIT N/A	45
2MB KIT N/A	87
4MB KIT N/A	178
8MB KIT N/A	312
16MB KIT N/A	625
386/25, /33, SERVER 386, 486/33, 486SX/20, 486EISA, SERVER 486	
1MB KIT N/A	45
4MB KIT N/A	178
16MB KIT N/A	625
64KB CACHE	38
3386-33 STEP-OLD VERSION	
4MB 581	389
64K CACHE MOD 582	158

hp

HP VECTRA 286/12	
1MB KIT D1640A	$ 49
2MB KIT D1354A	78
0-16MB E-C	129
386/16N, /20N	
2MB KIT D2406A	79
8MB KIT D2404A	285
QS/16S	
1MB KIT D1640A	56
2MB KIT D1354A	78
QS/20, RS/25C	
1MB KIT D1640A	56
4MB KIT D1643A	156
386/25PC	
2MB MOD D2381A	84
8MB MOD D2152A	250
486S/20	
1MB MOD D2150A	47
2MB MOD D2381A	84
4MB MOD D2156A	163
8MB MOD D2152A	250
486PC	
1MB MOD D2150A	47
4MB MOD D2156A	163
8MB MOD D2152A	250
486/25T, /33T	
2MB MOD D2381A	84
8MB MOD D2152A	250
9000/375, /380	
8MB KIT H98229B	450
16MB KIT H98229D	852
32MB KIT H98229E	1745
9000/400DL	
8MB KIT H98229B	450
16MB KIT H98229D	852
9000/400S	
8MB KIT H98229B	450
32MB KIT H98229E	1745
9000/400T	
4MB KIT H98229C	258
8MB KIT H98229B	450
9000/425S	
8MB KIT H98229B	450
16MB KIT H98229D	852
32MB KIT H98229E	1745
9000/425T	
4MB KIT H98229C	258
8MB KIT H98229B	450
16MB KIT H98229D	857
9000/433S	
8MB KIT H98229B	450
16MB KIT H98229D	852
32MB KIT H98229E	1745
DESKJET 500C, 500 PLUS	
256KB MOD H22707B	64
LASERJET II, IID	
1-4MB E-C H33443B	79
3-4 E-C H33444B	102
4MB E-C H33445B	108
1MB KIT N/A	59
LASERJET IIP, III, IIID, IIIP	
1-4MB E-C H33474B	59
2-4MB E-C H33475B	89
3-4MB E-C H33476B	125
4MB E-C H33477B	159
1MB KIT N/A	59
LASERJET IIISI	
1MB MOD C2063A	47
4MB MOD C2065A	140

LASER PRINTER MEMORY

FUJITSU RX 7100, 7200N	
2MB	$ 295
KONICA LP3110, 3115	
1MB	140
2MB	210
3MB	280
KYOCERA F1200S, F3300, F3300A	
1-2-3-4MB	CALL
KYOCERA F820, F1800, F1800A, F3000A, F5000	
1MB	98
SITOH-4 PLUS + BE	
1MB	120

IBM

N51SX NOTEBOOK	
2MB MOD 07G1879	$ 129
4MB MOD 07G1880	199
8MB MOD 07G1881	299
L40SX, N33SX LAPTOP	
2MB MOD 79F0999	99
4MB MOD 79F1000	149
8MB MOD 79F1001	289
P70 386	
2MB MOD 6450604	75
0-32MB E-C 6450605	199
P75 486	
2MB MOD 6450902	77
4MB MOD 6450128	125
PS/1 286	
512K MOD 1057035	34
2MB MOD 92F9935	65
PS/1 386SX	
512K MOD 1057035	34
2MB MOD 92F9935	65
4MB MOD 92F9694	130
MODEL 25	
128K KIT 78X8955	29
MODEL 25 286	
512K KIT 30F5348	24
2MB KIT 30F5360	79
0-16MB E-C N/A	129
MODEL 30 286	
512K KIT 30F5348	24
2MB KIT 30F5360	79
0-16MB E-C N/A	129
MODELS 35SX, 35LS, 40SX	
1MB MOD 6450603	42
2MB MOD 6450604	75
4MB MOD 87F9977	149
8MB MOD 6450129	299
MODELS 55SX, 55LS	
1MB MOD 6450603	42
2MB MOD 6450604	75
4MB MOD 87F9977	149
0-32MB E-C 6450609	299
MODEL 57SX	
2MB MOD 6450902	77
4MB MOD 6450128	149
8MB MOD 6450130	299
MODELS 70-081, 70-161	
1MB MOD 6450603	42
2MB MOD 6450604	75
0-32MN E-C 6450605	195
MODELS 70-A81, 70-A16	
2MB MOD 6450608	75
0-32MB E-C 6450605	195
MODELS 80081, 80161, 80132	
0-32MB E-C 6450605	195
MODELS A16, A31	
4MB MOD 6451000	189
0-32MB E-C 6450605	195
MODEL 90XP-HD STORAGE 0G5, 0G9	
2MB MOD 6450902	77
4MB MOD 6450128	149
8MB MOD 6450130	299
MODEL 90XP-HD STORAGE 0J5, 0J9	
MODEL 95XP-HD STORAGE 0G9, 0GF	
MODEL 95XP-HD STORAGE 0J9, 0J0, 0JF, 0KD, 0KF	
2MB MOD 6450902	77
4MB MOD 6450128	149
8MB MOD 6450130	299
16 BIT EXPANSION CARD FOR MODELS 50, 60, 55SX, 65SX, 55LS MAXIMUM TWO CARDS PER MACHINE	
0-32MB E-C 6450609	195
1MB MOD 6450603	42
2MB MOD 6450604	75
4MB MOD 87F9977	149
8MB MOD 6450129	299
32 BIT EXPANSION CARD FOR MODELS 70 & 80 MAXIMUM TWO CARDS PER MACHINE	
0-32MB E-C 6450609	195
1MB MOD 6450603	42
2MB MOD 6450604	75
4MB MOD 87F9977	149
8MB MOD 6450129	299
4019 & 4019E	
1-3.5MB E-C 1038136	79
2-3.5MB E-C 1038137	118
3.5MB E-C 1038675	159
1MB KIT N/A	59
1.5MB KIT N/A	79
4029-20, -040	
1MB MOD 1183333	59
2MB MOD 1183334	85
4MB MOD 1183335	157

NEC

ULTRALITE 286F	
1MB MOD PC2221	$ 88
4MB MOD PC2222	199
ULTRALITE SX/20	
2MB MOD PC4421	157
4MB MOD PC4422	530
ULTRALITE SL/20, SL/20P	
2MB MOD PC4721	166
8MB MOD PC4921	540
ULTALITE III, SL25C	
2MB MOD PC4721	166
4MB MOD PC4722	340
8MB MOD PC4723	879
PROSPEED 286	
1MB MOD PC2121	88
2MB MOD PC2126	120
4MB MOD PC2122	199
PROSPEED 386	
2MB MOD PC3121	120
8MB MOD PC3122	429
PROSPEED 386SX	
1MB MOD PC2121	88
2MB MOD PC2126	120
4MB MOD PC2122	199
PROSPEED 386SX/20	
1MB MOD PC4321	80
4MB MOD PC4322	199
PROSPEED 486SX, 486SX/C	
1MB MOD OP4106204	48
4MB MOD OP4106205	165
POWERMATE PORTABLE SX	
2MB E-C APCH751X	199
8MB E-C APCH753-754	895
POWERMATE PORTABLE PLUS	
1-3MB E-C APCH750J	219
2-3MB E-C N/A	299
3MB E-C N/A	379
POWERMATE SX	
2MB E-C APCH855	316
4-8MB E-C APCH853	486
8MB EC N/A	666
POWERMATE SX PLUS	
1-2MB E-C APCH850E	178
2MB E-C N/A	278
4-8MB E-C APC852E	378
8MB E-C N/A	578
POWERMATE SX/16	
2-8MB E-C OP4106201	213
2MB KIT N/A	84
POWERMATE SX/20	
2MB CPU MODULE OP4108101	172
2-8MB E-C OP4108102	213
2MB KIT N/A	84
POWERMATE SX/16I, SX/20I, SX/20VI, SX/20C	
2MB KIT OP4108103	84
8MB KIT OP4102101	289
POWERMATE 286C, 286 PLUS	
1-3MB E-C APCH250K	233
2-3MB E-C N/A	285
3MB E-C N/A	335
POWERMATE 386/20	
2MB MOD APCH655E	298
8MB MOD APCH656E	698
POWERMATE 386/25	
2MB MOD APCH655X	285
8MB MOD APCH656X	725
8MB 8MB APCH657X	725
POWERMATE 386/25S	
2MB KIT OP4105201	92
4MB KIT OP4105203	174
8MB KIT OP4105202	338
POWERMATE 386/33E	
2MB MOD OP4105101	185
POWERMATE386/33I	
1MB MOD OP4106204	62
4MB MOD OP4106205	188
16MB MOD OP4106206	698
POWERMATE 486/33I	
2MB KIT OP4108103	84
8MB KIT OP4102101	289
POWERMATE 486/25E	
2MB MOD OP4105101	209
POWERMATE EXPRESS 486/33E, /50E, 486SX/20E, /25E	
POWERMATE EXPRESS TOWER 486/25TE, /33TE, /50E, 486/SX25TE	
1MB MOD OP4106204	89
4MB MOD OP4106205	225
16MB MOD OP4106206	600
SILENTWRITER MODEL 90 & 290	
2MB MOD OP4892	130
SILENTWRITER MODEL 95	
2MB MOD 9502	125
SILENTWRITER MODEL 2	
2MB MOD 4892	130

Canon

LPB-4, -4PLUS	
1MB MOD S632240	$ 145
1-2MB E-C S632230	145
2MB E-C N/A	201
LBP-8II	
1-4MB E-C S631300	79
2-4MB E-C S631000	118
3MB E-C S631300	191
LBP-8III, -8PLUS	
1-3MB E-C S632340	145
2-3MB E-C S632350	201
3MB E-C S632360	377

SUN

SPARCSTATION ELC	
4MB MOD X104Q	$ 173
16MB MOD X116Q	609
SPARCSTATION IPC	
4MB KIT X104Y	184
16MB KIT X116Y	608
SPARCSTATION IPX	
4MB MOD X104U	173
16MB MOD X116U	609
SPARCSTATION 2	
16MB KIT X116W	608
SPARCSTATION 330	
8MB KIT X108E	408
32MB KIT X134A	2268
SPARC 1, 3/60, 60, 4/40, 60, 65	
4MB KIT X104C,G,H,Y	184
SPARC SLC (4/20)	
4MB MOD X116D	173
4/110	
16MB KIT X116D	608
SPARC II, 4/40, 60, 65, 75, 330, 370	
16MB KIT X116H,Y,W	608
4/330, 4/370	
8MB KIT X108E	408
32MB KIT N/A	2268

TI

TRAVELMATE 2000	
1MB MOD 2568034001	$ 99
TRAVELMATE 3000	
TRAVELMATE 3000WINSX	
2MB KIT 2566776001	99
TRAVELMATE 4000WINSX	
4MB MOD 2581265001	225
MICROLASER PLUS, XL	
MICROLASER PLUS TURBO	
1MB MOD 2557390001	61
2MB KIT N/A	129
4MB KIT N/A	240
8MB KIT N/A	480

TOSHIBA

T1000SE	
1MB C-C PCPA8311U	$ 66
2MB C-C PCPA8312U	100
T1000LE	
1MB C-C PCPA8311U	66
2MB C-C PCPA8312U	100
4MB C-C PCPA2001U	158
8MB C-C PCPA2002U	306
T1000XE	
1MB C-C PCPA8311U	56
2MB C-C PCPA8312U	100
T2000	
1MB C-C PC18PA8316U	95
2MB C-C PCPA2000U	100
4MB C-C PCPA2001U	158
8MB C-C PCPA2002U	306
T2000SX	
4MB PC14PA8314L	122
4MB C-C PC14PA8315L	306
T2000SXE, T2200SX	
2MB C-C PCPA2000U	100
4MB C-C PCPA2001U	158
[illegible] PCPA2002U	306
T3300SL	
2MB C-C PCPA2006U	138
4MB C-C PCPA2007U	174
8MB C-C PCPA2008U	246
T4400SX, T4400SXC, T6400	
2MB C-C PCPA2003U	158
4MB C-C PCPA2004U	240
8MB C-C PCPA2005U	432
16MB C-C N/A	768
T1200XE	
2MB MOD PC13PA8306U	95
T1600	
2MB MOD PC8PA8302U	95
T3100	
2MB MOD PC3PA7135E	204
T3100E	
2MB KIT PC8PA8341U	85
T3100SX	
2MB MOD PC15PA8308U	98
4MB MOD PC15PA8310U	144
T3200	
3MB MOD PC6PA7137U	144
T3200SX	
2MB KIT PC12PA8307U	83
4MB KIT PC12PA8308U	144
T3200SXC	
2MB KIT PC19PA8318U	83
4MB KIT PC19PA8319U	144
T5100	
2MB MOD PC7PA8301U	98
T5200, T5200C, T8500	
2MB KIT PCPA8304U	90
8MB KIT PCPA8313U	282
PAGELASER 6	
2-4MB E-C M8008I	114
4MB E-C M83100	174

Panasonic

CF-170, CF-270, CF-370	
1MB MOD CFBA165	$ 67
4MB MOD N/A	147
KX-P4410, KX-P4420, KX-P4430	
1-4MB E-C KXP443	82
2-4MB E-C KXP441	112
3-4MB E-C N/A	185
4MB E-C N/A	199
KX-P4450	
1MB E-C KXP448	128
KX-P4450I	
1-4MB E-C KXP443	82
2-4 MB E-C KXP441	112
3-4MB E-C N/A	188
4MB E-C N/A	199
KX-P4455	
2MB E-C KXP4455	187

SHARP

PC 6220	
1MB MOD CE621B	$ 99
PC 6641	
2MB KIT CE641D	99
PC 8501	
2MB MOD CE852B	261
PC 6640	
2MB MOD N/A	145
PC 4700, MZ200, 250	
1MB MOD CE471B	145
JX9500PS LASER	
1MB E-C JX95MJ	65
JX9500E, 9500H, 9700	
1MB C-C N/A	129
2.5MB C-C N/A	242
4MB C-C N/A	356

ZENITH

MASTERSPORT 286	
1MB MOD ZA2121	$ 110
MASTERSPORT 386SX	
2MB MOD ZA3601	191
MASTERSPORT386SL, 386SLE	
2MB MOD ZA44	99
SLIMSPORT	
1MB MOD ZA18095	132
2MB MOD ZA18084	199
4MB MOD ZA18071	385
TURBOSPORT 386	
1MB MOD ZA3034ME	133
TURBOSPORT 386E	
1MB MOD ZA3034ME	45
4MB MOD ZA3035ME	222
SUPERSPORT 286	
1MB MOD 18066	95
SUPERSPORT 286E	
1MB MOD ZA18066	85
2MB MOD ZA18084	108
4MB MOD ZA18071	399
SUPERSPORT SX	
2MB MOD ZA18084	108
2MB MOD ZA18086 ALPHA	108
2MB MOD ZA18087 BETA	108
Z-286LP PLUS	
2MB KIT Z6051	95
0-16MB E-C N/A	129
Z-386SX, Z-386SX/20	
2MB KIT Z6051	95
0-16MB E-C N/A	129
Z-386/20, /25, /33, /33E	
1MB MOD Z3800ME	42
4MB MOD Z3800MK	126
Z-486/33ET	
4MB KIT ZA4200M2	166
16MB KIT ZA4200M6	535

MAGNAVOX

NOTEBOOK METALIS 286, 386SX	
1MB MOD	$ 108
4MB MOD	298
HS500, 300, 386SX, 286	
1MB KIT	65
2MB KIT	85
4MB KIT	150
HS, PR, MX 1200, 286, HS, PR, MX 1000, MGP160 PR04CD, 386SX-15, HS, PRSX20, HS80CD 386-20SX, HS3300, 386-33 HS486, 486SX	
1MB SIMM	45
4MB SIMM	175

OKIDATA

OL 400	
1MB E-C 70014701	$ 91
2MB E-C N/A	129
OL 800, 820	
1MB E-C 70015201	95
2MB E-C N/A	155
3MB E-C N/A	199
4MB E-C N/A	225
OL 830, 840	
2MB E-C 70016501	185

BROTHER

HL-4, 4V, 4PS	
1MB E-C M8410	$ 125
2MB E-C M8420	165
4MB E-C M8440	245
HL-8, -8E, -8D, -8V	
1MB E-C M8810	85
2MB E-C M8820	125
BROL1-410, BROL2-420	
1MB KIT N/A	49

KINGSTON

SX/NOW! CPU PROCESSOR UPGRADES

AGI 1800A, B, C
AST PREMIUM 286, BRAVO 286
COMPAQ DESKPRO 286
PORTABLE III (PLCC)
PORTABLE III (PGA)
DESKPRO 386/16, 20, 20E, 25, 25E, 33
EPSON EQUITY IIE, II PLUS
IBM PS/2 50, 60, 50Z, 25/286, 30/286, AT, XT/286
HP VECTRA ES/12, ES/8
NEC POWERMATE 286+, PORTABLE+

20MHZ 386SX	$ 299
25MHZ 386SX	340
33MHZ 386SX	399

LAPTOP & NOTEBOOK

ALTIMA LAPTOP SX	
1MB MOD	$ 80
2MB MOD	150
4MB MOD	250
BONDWELL 8310 SUPERSLIM	
BONDWELL 8310V-8310SX	
1MB MOD	90
4MB MOD	295
CHICONY 386SX	
4MB MOD	195
CHAPLET NOTEBOOK	
1MB MOD	110
2MB MOD	150
4MB MOD	240
GOLDSTAR GS520 386SX/16	
1MB MOD	72
4MB MOD	265
HEWLETT PACKARD LS/12	
1MB MOD	110
HEWLETT PACKARD 95LX	
128K MOD	82
256K MOD	94
512K MOD	110
1MB MOD	205
2MB	342
4MB MOD	545
HYUNDAI 386SX	
4MB MOD	195
LIBREX 286	
2MB MOD	225
LEADING EDGE DLT/386SX	
1MB MOD	85
MITSUBA NINJA 286, 386SX	
1MB MOD	95
4MB MOD	210
PACKARD BELL PB286NB	
1MB MOD	99
4MB MOD	210
PACKARD BELL PB386NBX	
1MB MOD	99
2MB MOD	135
4MB MOD	240
POQUET	
128K MOD	82
256K MOD	94
512K MOD	110
1MB MOD	205
4MB MOD	545
SAMSUNG NOTEMASTER 386S-16	
2MB MOD	175
4MB MOD	376
SAMSUNG NOTEMASTER 386S-20	
2MB	105
4MB	305
8MB	409
SANYO 17NB, 18NB, 18NBS	
2MB MOD	90
SAMPO NBSX16	
1MB MOD	85
2MB MOD	145
4MB MOD	245
SAMPO NBSX25	
2MB MOD	145
4MB MOD	245
TANDON NB386SX	
1MB MOD	95
4MB MOD	288
8MB MOD	480
TANDY 15/10, 20/10, 30/10	
1MB	89
TANDY 20/20, 30/20	
2MB	345
6MB	575
TULIP LAPTOP	
4MB MOD	245
ZEOS NOTEBOOK	
2MB MOD	98

SILICON GRAPHICS

4D/30, 35, INDIGO RPC, 4D/120, SERIES 200, 300, 4D SERIES 100, 200, 300	
8MB KIT H4C08X	$ 885
32MB KIT H4C02X	1295
4D/20 PERSONAL IRIS, 4D25, 4D40, 4D50, 4D70, 4D80, CS/12, TURBO 12 & 16	
16MB KIT HU1C160	1295

ACER

ANYWHERE	
2MB CARD 1120NX	$ 127
4MB MOD 12407580	625
1100NX, 1100LS	
4MB KIT N/A	150
1100/16SX	
2MB KIT N/A	110
4MB KIT N/A	150
1100/20	
2MB KIT 9100023068	90
1100/25, 33	
4MB KIT 9100023004	150
1170, 11772, 1173	
2MB KIT N/A	80
4MB KIT 9148623002	175
8MB KIT 9148623003	285
1200	
4MB KIT 9148623002	175
8MB IT 9148623003	285
16MB KIT 9148623004	700

MOTHER BOARDS

ONE BOARD SOLUTION

386/486

386/486-64K Cache no CPU $200.

386/486-256K Cashe no CPU $250.

OPTI/UMC MOTHER BOARDS

386DX-25 CASHE W/CPU	$180
386DX-33-64K CACHE W/CPU	199
386DX-33-256K CACHE W/CPU	249
386DX-40-64K CACHE W/CPU	210
386DX-40-256K CACHE W/CPU	260
486DX-33-64K CACHE W/CPU	490
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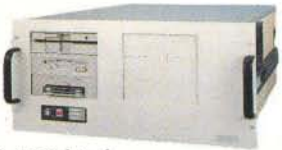

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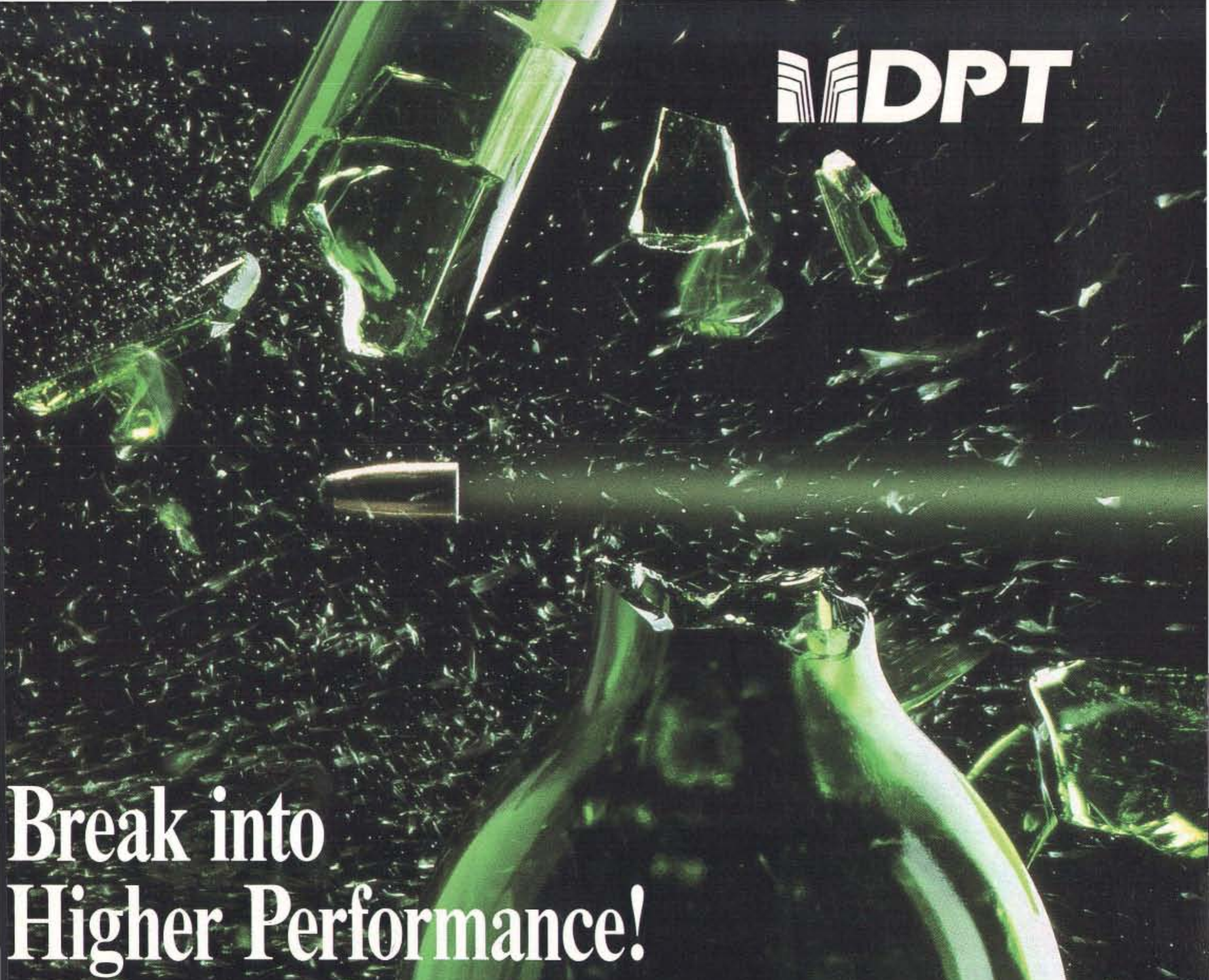

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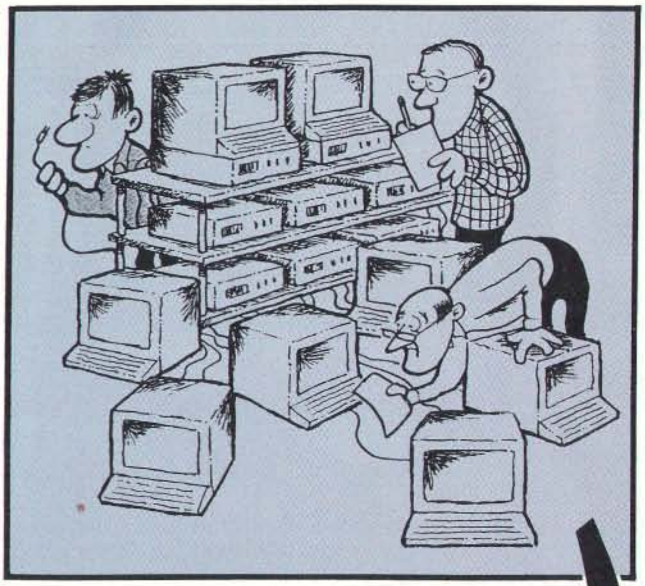

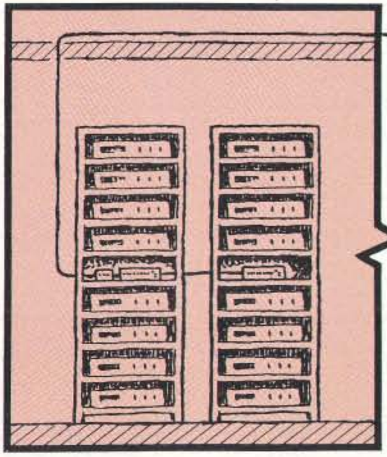

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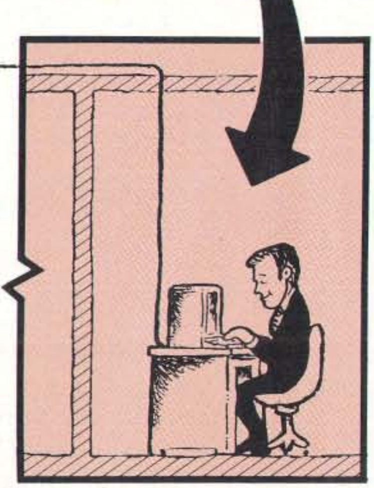

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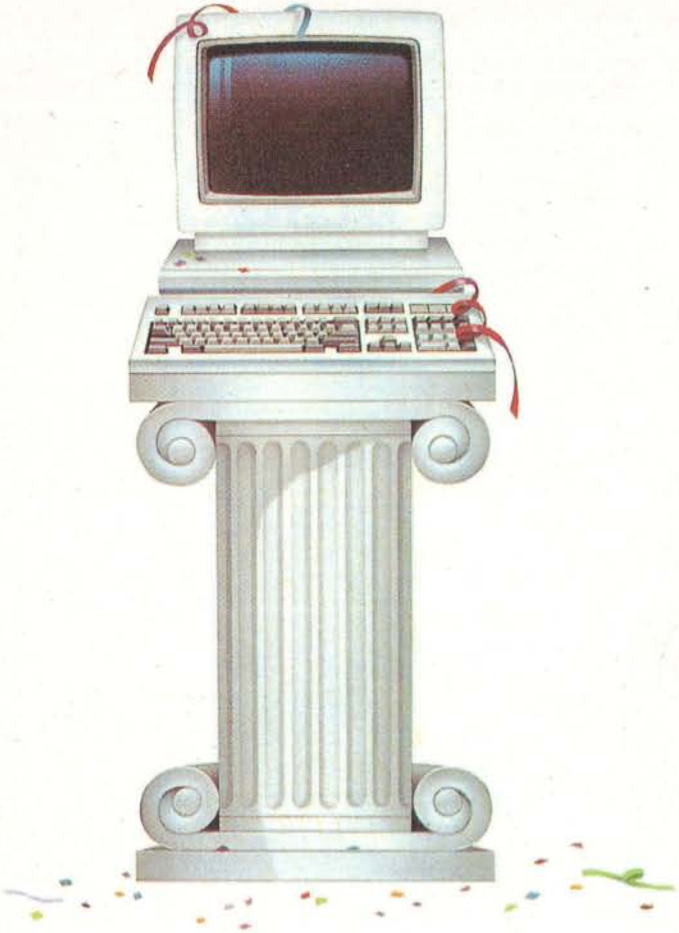

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	4MB MOD	PA8319U	$148
T3200	3MB BRD	PA7137U	$148
	2MB CRD	PA2006U	$118
	4MB CRD	PA2007U	$148
	6MB CRD	PA2008U	$235
	16MB CRD	PA2009U	$895
T4400 SX (SXC) (T6400 SXC DXC)	2MB CRD	PA2003U	$115
	4MB CRD	PA2004U	$189
	8MB CRD	PA2005U	$375
	16MB CRD	PA2010U	$745
T5100	2MB BRD	PA8301U	$78
T5200/T5200C/T8500	2MB MOD	PA8304U	$91
	8MB MOD	PA8313U	$298

COMPAQ Memory

MODEL	MEMORY	PART#	PRICE
Portable III	512K	107331-001	$38
	INTFC	107808-001	$99
	EXP BD	107811-001	$249
	2MB	107332-001	$98
Portable 386	1MB	107651-001	$119
	4MB EXP	107653-001	$449
	4MB DAGHT	107654-001	$449
Deskpro 386/16	1-2MB	108069-001	$248
	2MB	108069W71	$348
	1MB	108071-001	$98
	4-8MB	108070-001	$469
	4MB	108072-001	$249
Deskpro 286E; 386-20; 20E; 25; 25E	1MB	113131-001	$59
	4MB	113132-001	$158
Deskpro 386S	4MB Board	113634-001	$218
	4MB Module	112534-001	$159
Deskpro 386-20E; 25E	4MB	113645-001	$208
Deskpro 386/33; 386/33l; 486/25; 33L;50L; Systempro	2MB	115144-001	$102
	8MB	116561-001	$289
	32MB	116568-001	$1498
Deskpro 386M,486M, Systempro LT	2-64MB	129160-001	$358
Deskpro 286N; 386N; 386SX/20; 20N, Portable 486c, Deskpro M , Systempro LT Series 129160-001	1MB	118688-001	$49
	2MB	118689-001	$84
	4MB	118690-001	$148
	8MB	128877-001	$298
Prolina 3/25 & 25Z	2MB	141738-001	$89
	8MB	141742-001	$279

COMPAQ Laptop Memory

Contura Notebook/Laptop	2MB	139497-001	$88
	4MB	139498-001	$148
	8MB	139499-001	$298
Compaq SLT/286	1MEG MOD	110235-001	$99
	4MEG MOD	110237-001	$198
	1MEG MOD	118303-001	$89
	2MEG MOD	118304-001	$129
	4MEG MOD	118305-001	$165
Compaq Lte 286	1MEG BRD	117081-001	$69
	2MEG BRD	117081-002	$99
	4MEG BRD	117081-003	$148
Compaq Lte 386/20	1MEG MOD	121125-001	$78
	4MEG MOD	121125-002	$198
Compaq Lte Lite/20, 25	2MEG MOD	129769-001	$138
	4MEG MOD	129769-002	$198
	8MEG MOD	129769-003	$448

Laser Printer Memory

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Brother HL-8, 8E, 8D, 8V	$99	$149		$249	
Canon LBP4	$128	$178			
Epson Action Laser II	$95		$163		$229
Epson 6000, Action LSR		$99		$168	
Fujitsu 7100 & 7200	$199	$279			
HP Deskjet 500, 500C	$59 (256K)				
HP2, 2D, 3, 3D, 3P, 2P, 2P+		$99		$159	
HPIII SI	$49			$148	
HP Laser Jet 4				$158	
IBM Laser 4019, 4019E (3.5MB)				$169	
IBM Laser 4029				$149	
Konica LP3110/3115	$98	$159			
NEC 90, 290		$118			
NEC 95		$128			
OKI 400		$79			
Packard Bell PB9500		$125		$168	
Panasonic 4410/4430		$119		$168	
Panasonic 4420/44501	$89	$118		$168	
Panasonic 4450	$105				
Panasonic 4455		$139			
QMS 410	$109	$149		$249	
Star LS04	$129	$179		$269	
StarScript 4	$128	$178		$258	
Tosiba Page Laser 6		$109		$168	
TI	$79	$149		$299	
TI XL/PS17/PS35	$59				

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ALR Ventura 16 & 20	4MB	12407970	$895
AT&T Safari	2MB	37650	$148
AT&T Safari	4MB	37651	$268
Bondwell B-310	1MB	23050-09100	$108
Commodore	2MB	390850-01	$87
Dell 316, 320LT	2MB		$98
Dell NL20 & NL25	2MB	310-3213	$149
Dell 212N & 320N 1N+	2MB	P/IV 310-3204	$109
Everex Tempo LX, LX20	2MB	00160	$77
Everex Carrier	2MB	00263-00	$114
Epson NB3	4MB	A808511	$178
Grid 1500	4MB	52587	$198
Grid 1450SX	2MB	6200203	$148
Goldstar GS520, 386SX16	1MB	N/A	$98
Goldstar GS520, 386SX16	4MB	N/A	$248
Packard Bell, Magnavox, Mitsuba	1MB	N/A	$88
Packard Bell, Magnavox, Mitsuba	4MB	N/A	$198
Panasonic CF170/270/370	1MB	N/A	$55
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Sharp 6640	2MB	N/A	$248
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Sharp 8501 Colorstar	2MB	N/A	$398
Tandon NBE 386SX	1MB	N/A	$88
Tandon NBE 386SX	4MB	N/A	$299
TI Travelmate 2000, 3000	1MB	N/A	$88
TI Travelmate 3000	2MB	N/A	$78
TI Travelmate 4000	4MB	N/A	$218

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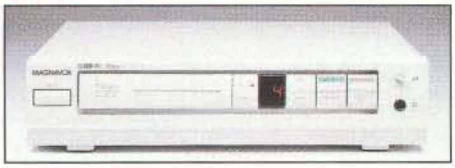

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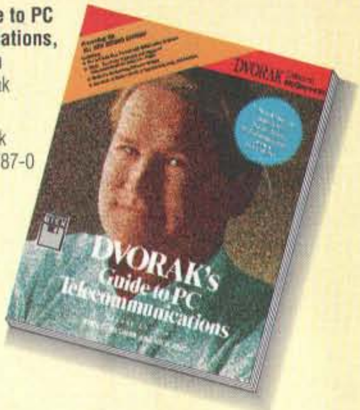

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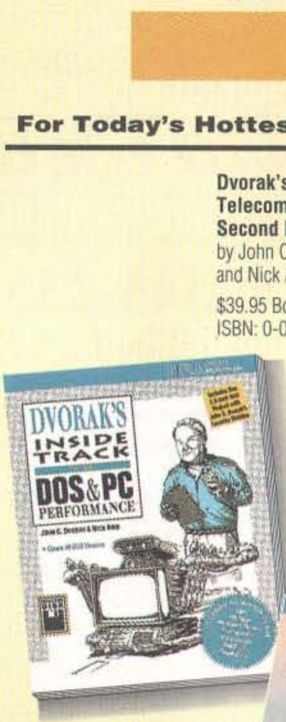

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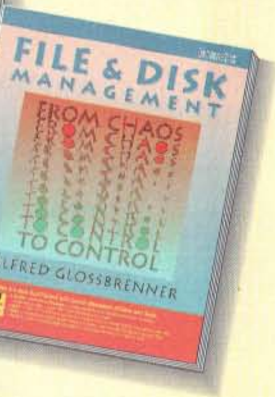

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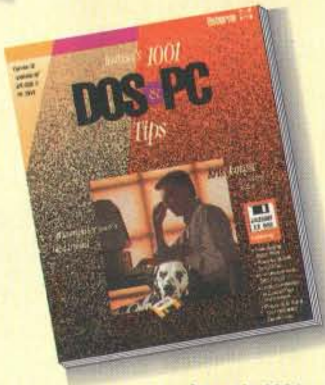

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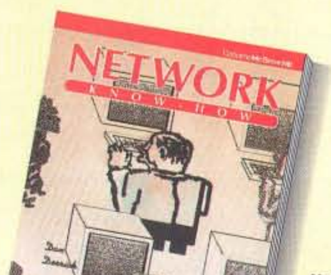

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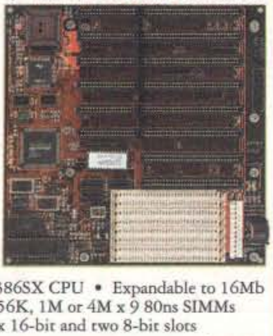

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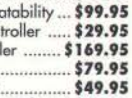

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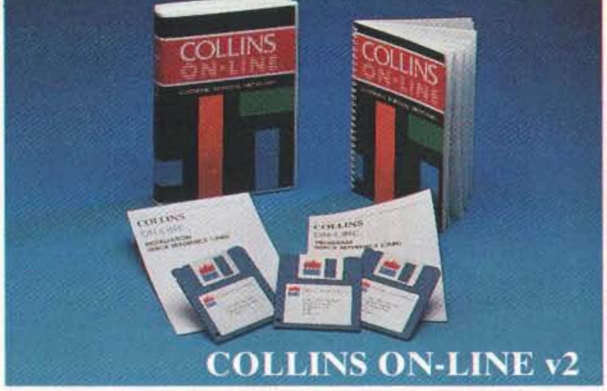

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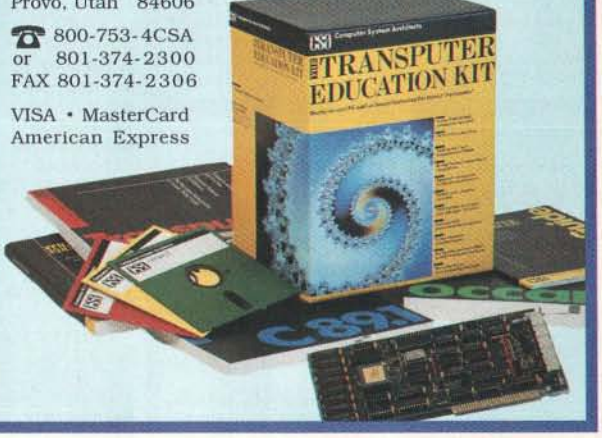

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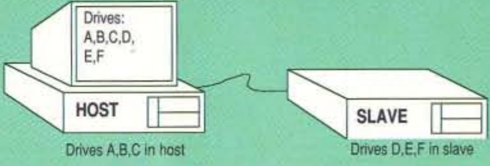

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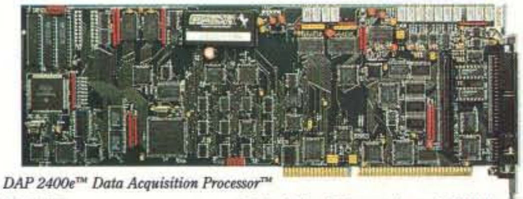

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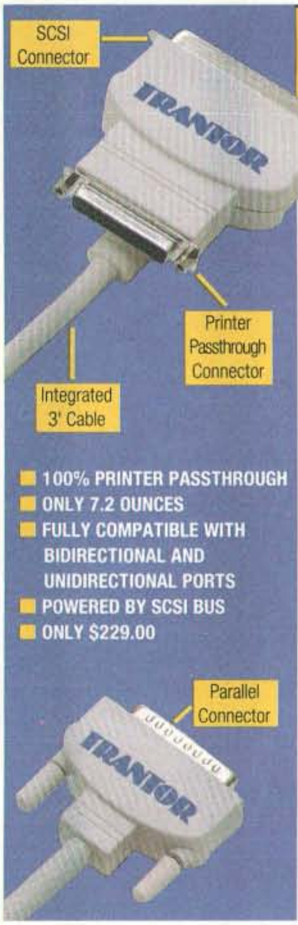

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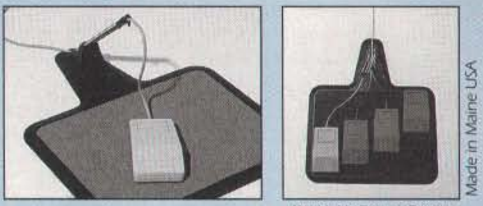

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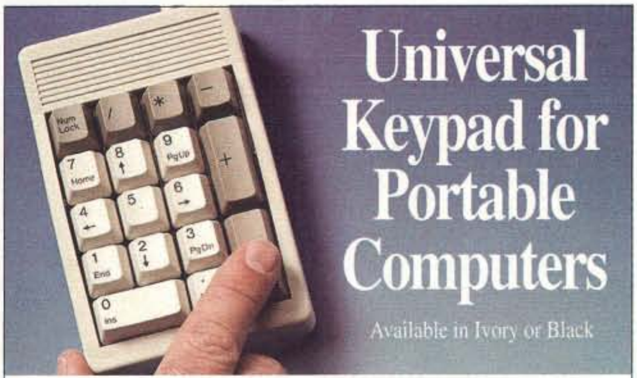
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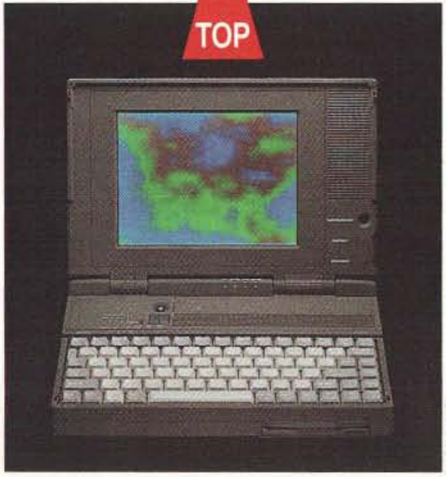

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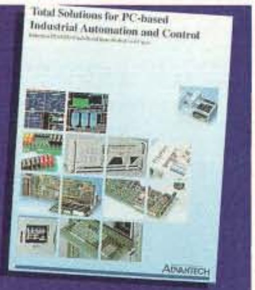
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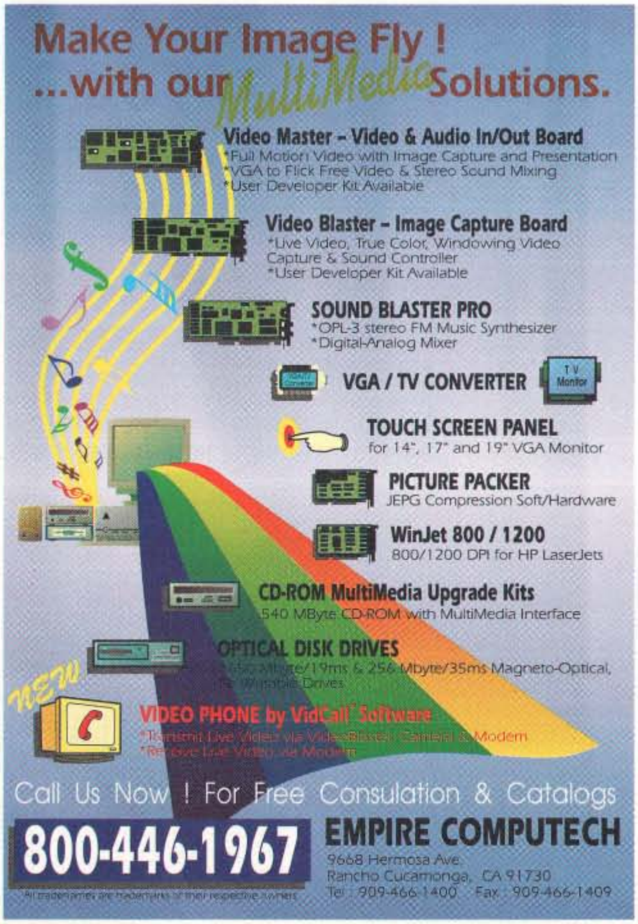

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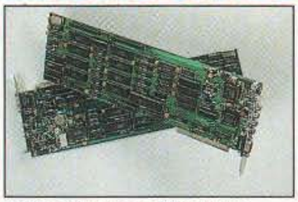

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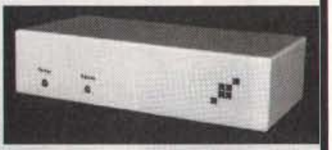

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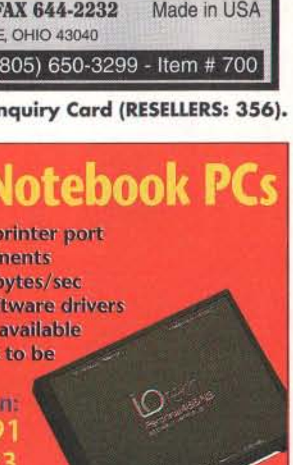

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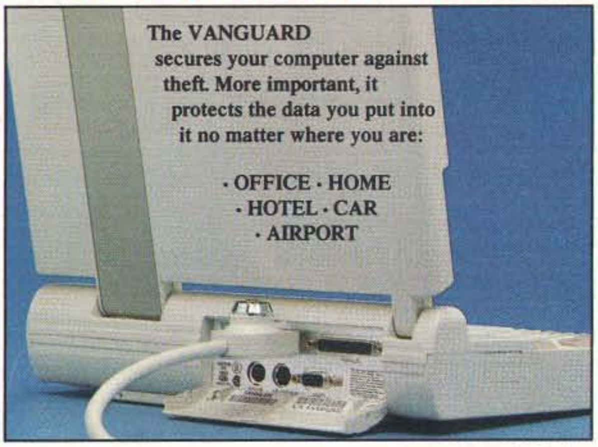

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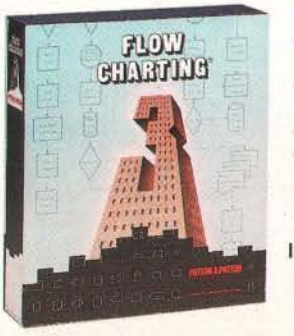

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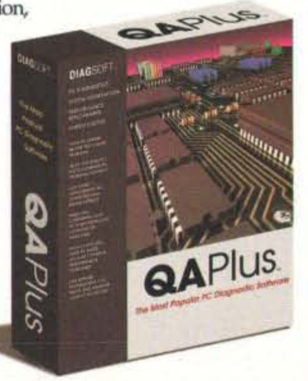

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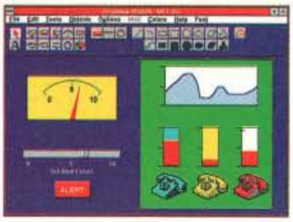

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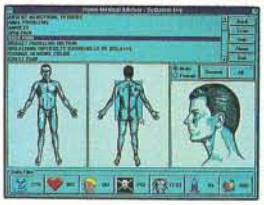

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203	POPKIN S/W & SYSTEMS INC	93	212-571-3434
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95	PROGRAMMER'S PARADISE	59-61	800-445-7899
*	PROGRAMMER'S SHOP	166-168	800-421-8006
*	PROGRAMMER'S SHOP	214-215	800-421-8006
204-205	PROGRESS SOFTWARE	236	800-4PROGRESS

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!

BYTE

Yes, I want FREE information on the following products!

Fill out this coupon carefully. ***Please Print.***

Name

Title

Company

Address

City Country Code

Phone Fax

A. What is your primary job function/principal area of responsibility? (Check one)
1 ☐ MIS/DIP
2 ☐ Programmer/Systems Analyst
3 ☐ Adminstration/Management
4 ☐ Sales/Marketing
5 ☐ Engineer/Scientist
6 ☐ Other

B. What is your level of management responsibility?
7 ☐ Senior-level 9 ☐ Professional
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?
10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)
12 ☐ PC/MS-DOS 15 ☐ Unix
13 ☐ DOS + Windows 16 ☐ MacOS
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?
18 ☐ 1-25 20 ☐ 51-99
19 ☐ 26-50 21 ☐ 100 or more

February 1993 *90 96 99*

Product Category Information

Circle the numbers below for information on the entire category of products you're interested in.

Hardware	
Accessories/Supplies	1
Add-in Boards	2
Bar Coding	3
Communications/Networking	4
Computer Systems	5
Data Acquisition	6
Disks & Optical Drives	7
Diskettes/Duplicators	8
Fax Boards/Machines	9
Graphics Tablets/Mice/ Pen Input	10
Keyboards	11
LAN Hardware	12
Laptops & Notebooks	13
Mail Order	14
Memory/Chips/Upgrades	15
Miscellaneous Hardware	16
Modems/Multiplexors	17
Monitors & Terminals	18
Multimedia	19
Printers/Plotters	20
Programmable Hardware	21
Scanners/OCR/Digitizers	22
Tape Drives	23
UPS	24
Software	
Business	25
CAD/CAM	26
Communications/Networking	27
Data Acquisition	28
Database	29
Educational	30
Engineering/Scientific	31
Entertainment	32
Graphics	33
Macintosh	34
Mail Order	35
Mathematical/Statistical	36
Miscellaneous Software	37
On-Line Services	38
Operating Systems	39
Programming Languages/ Tools	40
Security	41
Shareware	42
Software Duplication	43
Spreadsheets	44
Unix	45
Utilities	46
Windows	47
Word Processing	48
General	
Books/Publications	49
Recruitment	50
Miscellaneous	51

Inquiry Numbers 52-233

52	78	104	130	156	182	208
53	79	105	131	157	183	209
54	80	106	132	158	184	210
55	81	107	133	159	185	211
56	82	108	134	160	186	212
57	83	109	135	161	187	213
58	84	110	136	162	188	214
59	85	111	137	163	189	215
60	86	112	138	164	190	216
61	87	113	139	165	191	217
62	88	114	140	166	192	218
63	89	115	141	167	193	219
64	90	116	142	168	194	220
65	91	117	143	169	195	221
66	92	118	144	170	196	222
67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
73	99	125	151	177	203	229
74	100	126	152	178	204	230
75	101	127	153	179	205	231
76	102	128	154	180	206	232
77	103	129	155	181	207	233

Inquiry Numbers 234-408

234	259	284	309	334	359	384
235	260	285	310	335	360	385
236	261	286	311	336	361	386
237	262	287	312	337	362	387
238	263	288	313	338	363	388
239	264	289	314	339	364	389
240	265	290	315	340	365	390
241	266	291	316	341	366	391
242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
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251	276	301	326	351	376	401
252	277	302	327	352	377	402
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254	279	304	329	354	379	404
255	280	305	330	355	380	405
256	281	306	331	356	381	406
257	282	307	332	357	382	407
258	283	308	333	358	383	408

Inquiry Numbers 409-590

409	435	461	487	513	539	565
410	436	462	488	514	540	566
411	437	463	489	515	541	567
412	438	464	490	516	542	568
413	439	465	491	517	543	569
414	440	466	492	518	544	570
415	441	467	493	519	545	571
416	442	468	494	520	546	572
417	443	469	495	521	547	573
418	444	470	496	522	548	574
419	445	471	497	523	549	575
420	446	472	498	524	550	576
421	447	473	499	525	551	577
422	448	474	500	526	552	578
423	449	475	501	527	553	579
424	450	476	502	528	554	580
425	451	477	503	529	555	581
426	452	478	504	530	556	582
427	453	479	505	531	557	583
428	454	480	506	532	558	584
429	455	481	507	533	559	585
430	456	482	508	534	560	586
431	457	483	509	535	561	587
432	458	484	510	536	562	588
433	459	485	511	537	563	589
434	460	486	512	538	564	590

Inquiry Numbers 591-765

591	616	641	666	691	716	741
592	617	642	667	692	717	742
593	618	643	668	693	718	743
594	619	644	669	694	719	744
595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
613	638	663	688	713	738	763
614	639	664	689	714	739	764
615	640	665	690	715	740	765

Inquiry Numbers 766-947

766	792	818	844	870	896	922
767	793	819	845	871	897	923
768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

Inquiry Numbers 948-1122

948	973	998	1023	1048	1073	1098
949	974	999	1024	1049	1074	1099
950	975	1000	1025	1050	1075	1100
951	976	1001	1026	1051	1076	1101
952	977	1002	1027	1052	1077	1102
953	978	1003	1028	1053	1078	1103
954	979	1004	1029	1054	1079	1104
955	980	1005	1030	1055	1080	1105
956	981	1006	1031	1056	1081	1106
957	982	1007	1032	1057	1082	1107
958	983	1008	1033	1058	1083	1108
959	984	1009	1034	1059	1084	1109
960	985	1010	1035	1060	1085	1110
961	986	1011	1036	1061	1086	1111
962	987	1012	1037	1062	1087	1112
963	988	1013	1038	1063	1088	1113
964	989	1014	1039	1064	1089	1114
965	990	1015	1040	1065	1090	1115
966	991	1016	1041	1066	1091	1116
967	992	1017	1042	1067	1092	1117
968	993	1018	1043	1068	1093	1118
969	994	1019	1044	1069	1094	1119
970	995	1020	1045	1070	1095	1120
971	996	1021	1046	1071	1096	1121
972	997	1022	1047	1072	1097	1122

Inquiry Numbers 1123-1304

1123	1149	1175	1201	1227	1253	1279
1124	1150	1176	1202	1228	1254	1280
1125	1151	1177	1203	1229	1255	1281
1126	1152	1178	1204	1230	1256	1282
1127	1153	1179	1205	1231	1257	1283
1128	1154	1180	1206	1232	1258	1284
1129	1155	1181	1207	1233	1259	1285
1130	1156	1182	1208	1234	1260	1286
1131	1157	1183	1209	1235	1261	1287
1132	1158	1184	1210	1236	1262	1288
1133	1159	1185	1211	1237	1263	1289
1134	1160	1186	1212	1238	1264	1290
1135	1161	1187	1213	1239	1265	1291
1136	1162	1188	1214	1240	1266	1292
1137	1163	1189	1215	1241	1267	1293
1138	1164	1190	1216	1242	1268	1294
1139	1165	1191	1217	1243	1269	1295
1140	1166	1192	1218	1244	1270	1296
1141	1167	1193	1219	1245	1271	1297
1142	1168	1194	1220	1246	1272	1298
1143	1169	1195	1221	1247	1273	1299
1144	1170	1196	1222	1248	1274	1300
1145	1171	1197	1223	1249	1275	1301
1146	1172	1198	1224	1250	1276	1302
1147	1173	1199	1225	1251	1277	1303
1148	1174	1200	1226	1252	1278	1304

Inquiry Numbers 1305-1479

1305	1330	1355	1380	1405	1430	1455
1306	1331	1356	1381	1406	1431	1456
1307	1332	1357	1382	1407	1432	1457
1308	1333	1358	1383	1408	1433	1458
1309	1334	1359	1384	1409	1434	1459
1310	1335	1360	1385	1410	1435	1460
1311	1336	1361	1386	1411	1436	1461
1312	1337	1362	1387	1412	1437	1462
1313	1338	1363	1388	1413	1438	1463
1314	1339	1364	1389	1414	1439	1464
1315	1340	1365	1390	1415	1440	1465
1316	1341	1366	1391	1416	1441	1466
1317	1342	1367	1392	1417	1442	1467
1318	1343	1368	1393	1418	1443	1468
1319	1344	1369	1394	1419	1444	1469
1320	1345	1370	1395	1420	1445	1470
1321	1346	1371	1396	1421	1446	1471
1322	1347	1372	1397	1422	1447	1472
1323	1348	1373	1398	1423	1448	1473
1324	1349	1374	1399	1424	1449	1474
1325	1350	1375	1400	1425	1450	1475
1326	1351	1376	1401	1426	1451	1476
1327	1352	1377	1402	1427	1452	1477
1328	1353	1378	1403	1428	1453	1478
1329	1354	1379	1404	1429	1454	1479

YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

BYTE
TNT MAILFAST
FRG/BOS/700252/MO1
P.O. Box 66
Hounslow
TW5 9RT
England

PLACE
POSTAGE
HERE

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

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3. Product information will be rushed to you from the selected companies!

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Fill out this coupon carefully. ***Please Print.***

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Title

Company

Address

City Country Code

Phone Fax

A. What is your primary job function/principal area of responsibility? (Check one)

1 ☐ MIS/DP
2 ☐ Programmer/Systems Analyst
3 ☐ Adminstration/Management
4 ☐ Sales/Marketing
5 ☐ Engineer/Scientist
6 ☐ Other

B. What is your level of management responsibility?

7 ☐ Senior-level 9 ☐ Professional
8 ☐ Middle-level

C. Are you a reseller (VAR, VAD, Dealer, Consultant)?

10 ☐ Yes 11 ☐ No

D. What operating systems are you currently using? (Check all that apply)

12 ☐ PC/MS-DOS 15 ☐ Unix
13 ☐ DOS + Windows 16 ☐ MacOS
14 ☐ OS/2 17 ☐ VAX/VMS

E. For how many people do you influence the purchase of hardware or software?

18 ☐ 1-25 20 ☐ 51-99
19 ☐ 26-50 21 ☐ 100 or more

February 1993 *90 96 99*

Product Category Information

Circle the numbers below for information on the entire category of products you're interested in.

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Graphics Tablets/Mice/ Pen Input	10
Keyboards	11
LAN Hardware	12
Laptops & Notebooks	13
Mail Order	14
Memory/Chips/Upgrades	15
Miscellaneous Hardware	16
Modems/Multiplexors	17
Monitors & Terminals	18
Multimedia	19
Printers/Plotters	20
Programmable Hardware	21
Scanners/OCR/Digitizers	22
Tape Drives	23
UPS	24
Software	
Business	25
CAD/CAM	26
Communications/Networking	27
Data Acquisition	28
Database	29
Educational	30
Engineering/Scientific	31
Entertainment	32
Graphics	33
Macintosh	34
Mail Order	35
Mathematical/Statistical	36
Miscellaneous Software	37
On-Line Services	38
Operating Systems	39
Programming Languages/ Tools	40
Security	41
Shareware	42
Software Duplication	43
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Inquiry Numbers 52-233

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67	93	119	145	171	197	223
68	94	120	146	172	198	224
69	95	121	147	173	199	225
70	96	122	148	174	200	226
71	97	123	149	175	201	227
72	98	124	150	176	202	228
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242	267	292	317	342	367	392
243	268	293	318	343	368	393
244	269	294	319	344	369	394
245	270	295	320	345	370	395
246	271	296	321	346	371	396
247	272	297	322	347	372	397
248	273	298	323	348	373	398
249	274	299	324	349	374	399
250	275	300	325	350	375	400
251	276	301	326	351	376	401
252	277	302	327	352	377	402
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419	445	471	497	523	549	575
420	446	472	498	524	550	576
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425	451	477	503	529	555	581
426	452	478	504	530	556	582
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433	459	485	511	537	563	589
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593	618	643	668	693	718	743
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595	620	645	670	695	720	745
596	621	646	671	696	721	746
597	622	647	672	697	722	747
598	623	648	673	698	723	748
599	624	649	674	699	724	749
600	625	650	675	700	725	750
601	626	651	676	701	726	751
602	627	652	677	702	727	752
603	628	653	678	703	728	753
604	629	654	679	704	729	754
605	630	655	680	705	730	755
606	631	656	681	706	731	756
607	632	657	682	707	732	757
608	633	658	683	708	733	758
609	634	659	684	709	734	759
610	635	660	685	710	735	760
611	636	661	686	711	736	761
612	637	662	687	712	737	762
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614	639	664	689	714	739	764
615	640	665	690	715	740	765

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768	794	820	846	872	898	924
769	795	821	847	873	899	925
770	796	822	848	874	900	926
771	797	823	849	875	901	927
772	798	824	850	876	902	928
773	799	825	851	877	903	929
774	800	826	852	878	904	930
775	801	827	853	879	905	931
776	802	828	854	880	906	932
777	803	829	855	881	907	933
778	804	830	856	882	908	934
779	805	831	857	883	909	935
780	806	832	858	884	910	936
781	807	833	859	885	911	937
782	808	834	860	886	912	938
783	809	835	861	887	913	939
784	810	836	862	888	914	940
785	811	837	863	889	915	941
786	812	838	864	890	916	942
787	813	839	865	891	917	943
788	814	840	866	892	918	944
789	815	841	867	893	919	945
790	816	842	868	894	920	946
791	817	843	869	895	921	947

Inquiry Numbers 948-1122

948	973	998	1023	1048	1073	1098
949	974	999	1024	1049	1074	1099
950	975	1000	1025	1050	1075	1100
951	976	1001	1026	1051	1076	1101
952	977	1002	1027	1052	1077	1102
953	978	1003	1028	1053	1078	1103
954	979	1004	1029	1054	1079	1104
955	980	1005	1030	1055	1080	1105
956	981	1006	1031	1056	1081	1106
957	982	1007	1032	1057	1082	1107
958	983	1008	1033	1058	1083	1108
959	984	1009	1034	1059	1084	1109
960	985	1010	1035	1060	1085	1110
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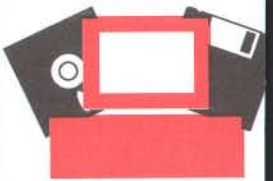

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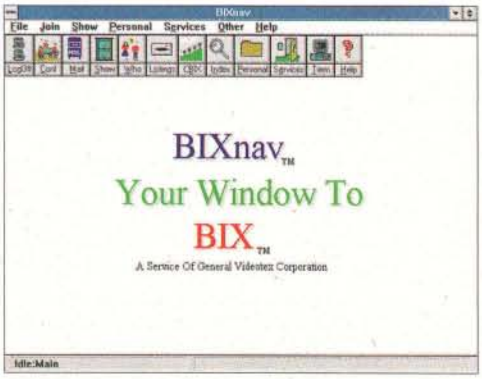
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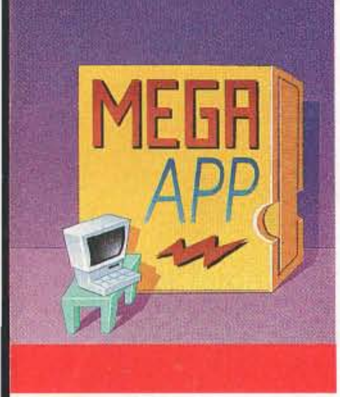

STOP BIT

ANDY NICHOLSON

SOFTWARE GLUTTONY

Software developers in the personal computer industry have lost their way. They're writing software that's inefficient on today's computers, all the while assuming that tomorrow's computers will be powerful enough to carry the extra burden. This is a serious error. In their rush to provide every imaginable feature in their programs, developers have lost sight of what their customers really want.

A new world of bloated software threatens to consume all computing resources in its path

Not everyone wants to upgrade to tomorrow's hardware, and users are increasingly moving toward notebook computers, which are a step behind today's desktop machines in terms of available resources. These notebook computers must struggle to run today's crop of bloated desktop applications. Given current trends in software development, they will be unable to run the even-bigger software of tomorrow.

If users considered notebook computers ineffective because they lack the capacity to run big software, they might be less likely to buy one. But the truth is that users are more willing to buy a notebook computer than to upgrade an existing desktop computer. Thus, a huge new market is caught in a software catch-22, where buyers wait for notebook computers that are powerful enough to run their new software while software developers bog down hardware with ever-larger applications. Programmers must analyze their audience and the limitations of their preferred hardware. They must create software that is efficient on today's computers or risk losing out to those who do.

Some programmers consider this approach to be an unnecessary limitation on their creative abilities. They are being held back, they say. Their imagination cannot run free in a world of limited memory and CPU power, they say. They're being unrealistic. Gluttony is the mark of a bad programmer.

Good programmers should always follow the principles of elegance, simplicity, economy, and effectiveness in their work. The aesthetics of quality programming require economical use of resources. No matter how fast the CPU, a wasted cycle is a wasted cycle. Programmers must avoid waste by squeezing all the fat from their programs.

Big resource-hogging programs are easy to find. The X Window System once ran fine on a 4-MB Sun-3/50 workstation, but the latest version doesn't perk up until you upgrade to an 8-MB Sparcstation. And you better have 16 MB if you want to run programs using bloated X toolkits like OpenWindows or Motif. The PC world is not immune to such overindulgence. Word processors like Microsoft Word and WordPerfect come stuffed with every imaginable option and gorge themselves on as much as 15 MB of disk space and 4 MB of memory.

The fantastically successful Lotus 1-2-3 offers programmers an instructive example. The original IBM PC version of VisiCalc did not take advantage of the IBM PC's increased capabilities. Microsoft grabbed the opportunity to produce a powerful, full-featured spreadsheet with Multiplan, winning numerous accolades and awards. Lotus 1-2-3 came to market later and without as much fanfare, but it was smaller and faster, and it eclipsed Multiplan almost immediately. Lotus 1-2-3 offered more spreadsheet power by taking the best advantage of the IBM PC.

The moral is to design software that works well today and allows for improvements tomorrow. Then implement the code to work well on today's hardware. The ingenuity, originality, and foresight of your design will become increasingly apparent as it outperforms competitors on forthcoming generations of faster hardware.

Start your work on the smallest, lightest notebook computer you can find, and use all your cleverness, ingenuity, and creativity to write software that makes the best possible use of the resources in the machine. The hardware limits you now, but people can use it today, and you will have a solid foundation for growth.

Now watch as your existing customers tell their friends. The friends who buy the latest hardware with your software will want more. Let your mind wander. What new features can you add to make the best possible use of the new hardware? What clever techniques can you use? What can you do to put yourself another generation ahead of your competitors? Program for your audience, not your ego, and your customers will love you. ■

Andy Nicholson is a senior programmer/analyst working in network software development at Cray Research (Eagan, MN). You can reach him on BIX c/o "editors" or on the Internet at droid@cray.com.

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